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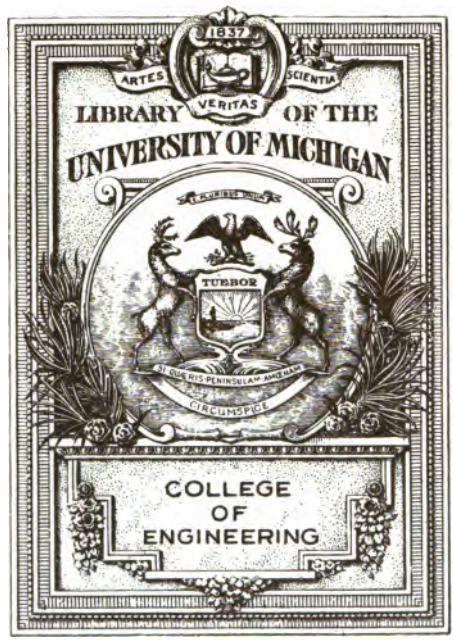
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WHY MANUFACTURERS LOSE MONEY

BY

ROBERT GRIMSHAW

NEW YORK
D. VAN NOSTRAND COMPANY
EIGHT WARREN STREET
1922

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Wahr
8392
Eng. Chem.
3-2-1823
Eng. fdt. (For chem. lib.)

PRINTED IN THE UNITED STATES OF AMERICA

To

THAT MERCILESS CRITIC AND DEAR COMRADE

MY WIFE

418849

FOREWORD

This work is the outcome of several series of lectures on Cost Reduction, delivered in Germany and Austria in 1913 and 1914, in New York University in 1915 and 1916, and still later in the College of the City of New York; supplemented by an article on "Why Foundries Lose Money" in *The Foundry,* (reprinted twice in my *Industrial Bulletin.* While it does not pretend to cover the ground exhaustively, or even concretely, it does name practically all the principal and most of the minor causes of loss; and should at least serve as food for thought and incentive to action.

The classifications, which have given me no end of trouble, may please my critics even less than they do me. They are, however, the best that I have been able to evolve from the great variety of possible treatments that suggested themselves.

WASHINGTON BRIDGE P. O., N. Y. CITY
August, 1922.

INTRODUCTION

In considering at length the many reasons why manufacturers either actually lose money, or make less profit than they should, it is desirable to classify them broadly on some general principles.

For this purpose I have divided them according to the following classes:

Financial
Commercial
Organizational
Accounting
Technical
Personal
Miscellaneous.

Under each of these will be found suitable subheads and minor divisions, with cross references where desirable.

WHY MANUFACTURERS LOSE MONEY

FINANCIAL CAUSES OF LOSS

These are such as affect every line of manufacturing business, and are caused by the financial management, as distinct from the commercial or sales department. They may be considered under the heads of:

(1) Insufficient capital
(2) Over-capitalization
(3) Inefficient credit department, giving either
    (*a*) Too liberal credit, or
    (*b*) Too little credit
(4) Insufficient reserve funds
(5) Lack of business connections
(6) Business *incubi*
(7) Slow collections
(8) Unbalanced appropriations
(9) Bad purchasing methods.

Insufficient Capital. Very little need be said under this title. While fortunes have been, still are, and probably ever will be made on a "shoestring" basis, this is seldom the case with manufacturing. "Biting off more than one can chew" is a frequent cause of loss, even of bankruptcy.

As I write I have a letter from a manufacturing concern having a valuable specialty, lamenting inability to take part in a pool for exporting American products. Owing to financial weakness there is not enough money to run the plant to sufficient capacity even to satisfy the domestic demands, much less to go after foreign trade. Credit had been given recklessly, in some instances; a new manager had been appointed solely because he bought the stock, orders had to be refused because there was no cash to buy raw materials, and so on.[1]

Over-Capitalization. This refers principally to "water." A concern that is expected to pay ten per cent on $10,000,000 when it could not possibly earn that amount on $5,000,000, must record "losses."

There are instances, however, where real over-capitalization exists and causes loss because a large part of the capital is drawing only six per cent at most, while the rest, constituting the real working capital, is earning ten or twelve. In such a case the "loss" consists in diminished potential profits.

Inefficient Credit Department. The inefficiency or incompetency of the credit department may consist in either

(1) Granting credit where it is not warranted, or

(2) Being too rigid in this respect.

The first case calls for no illustration; the second, however, is not always taken for granted. But that

[1] Non-utilization of full manufacturing capacity is also treated under Organization, Technical and Commercial Causes.

a credit manager may be too sharp; too anxious to reduce the percentage of so called bad bills, irrespective of net profits, is seen in the following concrete example:

To cut down this percentage he refuses credit entirely to many firms. At 10 per cent net profit, 95 per cent collected on $100,000 turnover might be more advantageous than 98 per cent collections on only $50,000 yielding $9,500 net, as against only $4,900.

Very often, not only is credit awarded were it is not safe, but merchants and manufacturers are driven to loss by being sold more goods than they can possibly sell to advantage. The fault is of course shared by the sales department, which should not load customers up with more stock than they can unload to advantage on the public.

There is an old and true saying that it is bad policy either to give credit to a "doubtful" customer, or to dun a good one.

Insufficient Credit. While capital is a good thing to have, credit is often a better. The late J. P. Morgan expressed himself very plainly on this point. Some firms, taking advantage of their capital and connections, neglect to pay their bills when due, hence their commercial ratings show large capital but doubtful credit. Other reasons for insufficient credit even in the fact of liberal capital are: — previous reputation for shady dealings, and present reputation for overdaring.

A very large firm once wrote me a savage letter for

dunning it; calling special attention to its credit being gilt edged. My reply was: "What good is your rating to me, when you don't pay your bills as agreed?"

Excessive Credit. At first glance this would seem a singular cause of financial loss; yet in my personal acquaintance it occasioned the bankruptcy of a very worthy and competent young jeweler. Every one knew and liked him; his sterling honesty and his skill and wide acquaintance would seem to guarantee success when he went into business for himself. But salesmen, confident in his probity and ability, loaded him up with more diamonds than he could possibly make up and sell; and his independent business career was short.

Insufficient Reserve. There are two sorts of capital: that which suffices to start and run the business, and that kept in reserve for the purpose of extending it in good times, or of keeping it going during business depression or panic. For this reason there should always be in reserve, or at least in sight where it can be brought into action, a certain amount of capital entirely independent of that which runs things under normal conditions. The business should have this reserve either properly invested where it can be got at promptly without sacrifice, or promised from quarters where absolute reliance can be placed.

Viewing the matter from the purely financial standpoint, it is perfectly possible for a manufacturing establishment which had been declaring good dividends out of profits for years, suddenly to commence passing

them, even in the face of abundant orders. In fact, losses may be due to the size of the past dividends, which should have been smaller, to allow for reserve to cover depreciation of equipment, and provide for expansion. It is not sufficient merely to write off ten per cent a year from the value of the equipment as assets; but an amount should be set aside yearly, which will replace the equipment when scrapped. The law requires this of corporations; but many a private concern is robbed and abandoned by a management which " takes no care for the morrow."

Lack of Business Connections. When a number of operatives in Wilmington car shops decided that the proprietors were making too much money, and decided to start a coöperative shop in Oxford, Pennsylvania, they found to their great disgust that they did not know either where to go after orders or where to buy their raw materials to advantage; nor had they any banking connection to assist them to raise working capital after they had paid for the works. The enterprise was a failure for lack of business connections.

Business Incubi. We all remember Sinbad the Sailor and the Old Man of the Sea. Many a manufacturing establishment has a similar incubus in the way of a business connection — a bank that demands excessive deposits and interest, a backer who insists on supplying raw material at exorbitant prices or invests his money on condition of being chosen Chairman of the Board of Directors at a high salary. I remember one establishment in Germany where I

found a number of milling machines which were not only unused but entirely uncalled for. On inquiring how the purchasing agent happened to load the concern up with these, I learned that the bank which held the majority of stock in the concern was similarly interested in the shop that made the millers; and stipulated, in investing, that it should deliver a certain number of machine tools of that make. There are establishments with us that are similarly compelled to buy wretched coal, or lumber, at excessive prices. So long as these *incubi* weigh down a manufactory, it can have but little chance of any great measure of success.

Bad Purchasing Methods. One might think, at first, that criticism of purchasing methods should be considered as a purely financial matter. It is a matter of organization, too; but the principal reason for considering it under financial causes of loss are that such losses come largely through

(1) Bad judgment as to price or quality

(2) Rashness on the one hand, or lack of nerve on the other.

Overdue Accounts eat up dividends to a much greater extent than is generally known, or at least admitted. Especially where goods are sold to a distance and it is consequently comparatively easy for customers to inch up in the matter of remittances, especial attention should be paid to this matter. Supposing that the amount monthly overdue averages $100,000, and the time taken by the customers beyond that accorded by the terms of sale averages ten days,

that makes at six percent a year interest a loss of $133.33 on each month's collection, or $1600 a year; which is just six percent on $26,667.

Unbalanced Appropriations. It is as essential that the appropriations for various operative expenses be well balanced among each other as that the equipment shall be so thought out and maintained that under normal conditions each production center can take care of the output of the one behind it and keep the one ahead of it fully busy. Yet few firms, in making such appropriations, consider how skimping on that for one productive factor may hamper one or more others; or that excess in one may be useless on account of the limitations of other to normal.

These remarks apply as well to balancing of the labor appropriation against that for equipment as to the proper relation of one operative center appropriation to the rest. In railroading, for example, we have constant jealousy between the permanent way and the motive power departments; going so far that the former calls for hard rails while the latter demands hard driving-wheel tires; each desiring that its own wear and tear account shall be low, irrespective of the other's, or of which wear and tear would be the cheaper to replace.

Over-Ordering of Raw Materials and Supplies is a source of loss through interest, depreciation and insurance; besides which there is danger of the stock getting out of fashion, or for other reasons obsolete,

and having to be scrapped or sold at a loss, if it can not be utilized to advantage.

Under-Stocking calls for little comment other than that concerning over-ordering. The purchasing agent should keep constantly in touch with the sales and production departments, and preserve the *juste milieu* in his purchases.

Hasty Purchases may cause regret. The buyer should keep his finger on the pulse of the market and always know just whether the trend is upward or downward, the changes rapid or deliberate. If he loses his head and buys in a panic, he usually makes bad bargains.

COMMERCIAL LOSSES

Commercial Losses may be caused either

(1) From within, or

(2) From without; may be in connection with either

(3) Buying,

(4) Shipping,

(5) Selling, or

(6) Transportation; may be due to either

(7) Individuals,

(8) The general public, or

(9) The market as such; may be either

(10) Avoidable, or

(11) Inevitable; and may be caused by either

(12) Product, or

(13) Methods.

Among so many and so different classifications it is difficult to choose; especially as some causes could come almost indifferently under any two or more of the above headings.

Commercial Losses from Within are those relating to

(1) Inefficient purchasing

(2) Theft

(3) Wastage.

Inefficient Purchasing. The buyer may control the destinies of the house. We will say that linseed oil, which is the principal item of expense in oilcloth making, is at 65 cents a gallon. It may go up a trifle, and stay up, or it may rush up and drop again. Shall the buyer gamble on either side? Half a million gallons would not break the Company, but might give it the market. One buyer orders the half million — and then some. Another sits tight. Oil goes up to $1.80. The first buyer is ahead of the game. The other had not sufficient foresight to be a good war buyer. It is the same all the way along the line of manufacturers. No buyer absolutely knows "which way the cat will jump"; but some seem always to have guessed correctly.

Inefficient purchasing may be through

(1) Ignorance of prices
(2) Omission to get competitive bids
(3) Ignorance of the goods
(4) Ignorance of sources
(5) Ignorance of trade usages
(6) Purchasing in too large quantities
(7) Ignorance of proper season to buy
(8) Just plain graft
(9) Nepotism.

(See also under "Financial Losses.")

Ignorance of Prices. It would seem almost incredible that a "buyer" would not know what materials and supplies were worth not merely in the local market but elsewhere or at the sources of supply.

But any one who will inspect the prices paid by the different departments of our Government for standard articles will see that while at times the purchasing agents are unwilling to pay at retail the actual manufacturing cost of hundred or thousand lots, at others they pay more than the prices openly advertised in the trade papers or the dailies, or ticketed on the goods in shop windows which they pass every day.

Omission to Get Competitive Bids eats up profits; as some vendors are so anxious to "get the trade" of important concerns that they will sell at a loss, hoping to recoup on later orders. Some purchasing agents are "on to the curves" in certain trades (notably printing) and get all their supplies at or below cost, by asking for tenders on each successive lot.

Ignorance of the Goods. We laugh at the story of the city-bred woman who on removing to the country refused to accept milk because it greased the glasses; she wanted "the genuine sky-blue article." Yet I have known the purchasing agent of a railway refuse rubber car springs (in the days before steel volutes came into use) because they were lighter than others of the same dimensions. So he paid rubber prices for barytes.

Ignorance of Sources. The Germans have what they call "commercial geographies" which ignore physical contours and political boundaries, but show by symbols the original sources of all important raw materials. Americans have not got so far; so they have been buying in Germany both materials and

manufactured articles not one of which originated in that country. In fact, for a long time an American dynamite factory bought infusorial earth from Hannover when there was a deposit thereof right on its own property. We bought Canadian furs from Leipzig for years before the great war.

Ignorance of Trade Usages. I have known buyers to get badly "stuck" by ignorance of what constitutes a certain unit according to custom, as opposed to either statute or common law. I myself suffered severe loss by ordering "gun metal" castings in South Boston, where that expression meant a high grade of cast iron; whereas I only knew it as an eight-to-one copper and tin alloy. In the same way the buyer of Russian bristles may have to pay by weight for the heavy cord wrapping the small bundles.

Purchasing in Too Large Quantities causes, at times, waste; but it may be because of lack of consultation with the production or the sales department, so that the materials or supplies remain unused either forever, or for such a length of time that they either spoil or become obsolete.

Ignorance of Best Season to Buy. Prices go up on account of

(1) Extra demand, and

(2) Diminished supply.

If now the buyer is new in the line in question, he may run up against one or both of these price-boosting factors.

"Just Plain Graft." I consider this distinct from

theft pure and simple — if there be such a thing as pure and simple theft. Where buyers and foremen receive a bonus for the introduction of a product, the employer pays in the long run, if not sooner. Graft may consist in commissions paid or in favors granted; or it may be in the way of sabotage — as where the German dye manufacturers paid workmen to see to it that American dyes gave bad results. It is very seldom that a product which has to be grafted on, as it were, is as good as the one which it supplants; so there is another loss besides the extra price which the manufacturer has to pay.

An American woman housekeeping in Paris complained that her servants got the well known "sou in the franc" on all household purchases, hence were purposely wasteful of all things — even going so far as to pour kerosene and vinegar down the sink. But the money which sent her and her children to France for a year's recreation and study, her husband got by just such practices at home.

From the janitor who gets ten cents on the ton for slaty coal, and the pressman who cashes in a cent a pound on printing ink, up to the street railway director whose wife accumulates stock in a storage-battery factory, there are grades and grades of graft.

Nepotism originally meant appointing one's nephews and other relatives to sinecures. It may be extended to buying supplies of one's relatives at prices above what the same articles would cost elsewhere.

Wastage of Supplies occurs in greater percentage

in the office than in the factory; and is, as a rule, much less excusable. But even in the shop I have seen such signs as "Do not wash your hands with machine oil and waste." All such loss, in shop or office, is difficult to calculate and more difficult to distribute; but not hard to keep down.

Excessive Postage is common, and excessive telephoning still more so, even where the 'phone is used strictly for business purposes. But private 'phoning is so easily done and so difficult to control — even in oneself — that it pours many a dollar into the waste basket.

Excessive Telegraphing may be either

(1) In number of messages, or

(2) In length thereof.

In both, judgment must be exercised. Travelers are sometimes censured for using the wire liberally where they really save hotel bills thereby, or prevent misdirection of letters or telegrams.

Commercial Losses from Without come under the heads of

(1) Bad debts

(2) Bad investments

(3) Robbery

(4) Drops in the market.

Bad Debts may be due to either

(5) The salesmen

(6) The credit department

(7) The collection department, or

(8) Business conditions.

Bad Investments[1] may be in

(9) Land
(10) Buildings
(11) Stocks, etc., for surplus and reserves.

Robbery takes place frequently in connection with the pay roll (holding up the messenger); but may be straight burglary.

Drops in the Market[2] may "hit on all four cylinders." Some may be foreseen; but the purchasing agent or the head salesman who could prophesy every fall in prices in any one important line could command $100,000 and upwards as salary, without difficulty.

Losses Due to Individuals are considered elsewhere under various heads and sub-heads.

Losses Through the General Public need not be treated here under any special heading, as they are considered in many other places.

Losses Through the Market are caused among other things, by

(1) Depression
(2) Panic
(3) Dumping
(4) Unfavorable exchange
(5) Shifting of the population
(6) Original lack of market.

Depression in the Market is usually beyond the manufacturer's power to prevent. Sometimes, however, he is the direct cause thereof; for instance where

[1] These might more properly go under the head of "Financial."
[2] See also under "Selling Losses."

he holds the price so high by practical monopoly of an unpatented article as to invite the erection of rival establishments. This happened in the glucose industry some years ago, when the original manufacturers, by inordinate prices, caused a rush to "get in while the getting was good." The same thing could happen in the oil business if the Standard companies tried to boost prices inordinately; you and I and all our relatives and friends would perforate the entire continent; oil prices at the same time.

Depression in the market may of course find the manufacturer with wares that he expected to sell at a good profit, but which he is compelled either

(*A*) To unload
- (1) At less profit than expected
- (2) At cost, or
- (3) At an actual loss; or

(*B*) To hold at a loss for
- (1) Interest
- (2) Depreciation
  - (*a*) Physical
  - (*b*) By obsolescence
- (3) Storage expense
- (4) Insurance.

Panic in the Market exposes the manufacturer to the same risk and losses as depression, but in greater degree.

Dumping has long been a favorite (and successful) German method of commercial warfare, and naturally may cause either

(1) Depression, or

(2) Panic.

In this connection Stanley Frost's "Germany's New War against America," which gives many concrete examples, may be read with profit.

The dumping manufacturer, if he has sufficient capital, "sand" and made-up stock, first beats down prices and ruins competition, then advances them sufficiently to more than recoup his primary losses. In many instances, moderate and even immoderate dumping

(1) Preserves the original organization intact

(2) Holds the workers together on the spot

(3) Acts permanently as a sword hanging by a mere thread over the rivals' heads.

Unfavorable Exchange is a condition brought about artificially, often unnecessarily, sometimes by the machinations of bankers or even governments. As I write, with the franc worth, in the United States, only eight cents instead of 18.4, and the mark at about 0.13 cents instead of 23.8, the French and the Germans cannot afford to buy our goods in any quantity, for cash. This is a penalty that we are paying for holding half the visible gold supply of the world.

Shifting of the Population. In some old and many new districts, the population dies out or drifts away to such an extent that local manufacturers dependent for their prosperity on locally delivered raw materials, on local labor, or on local consumption, have had to close out when their losses became serious and the eventual continuance of loss seemed a matter of

certainty. Just as there are thousands of abandoned farms in some of our New England States, so there are thousands of abandoned lime-kilns, saw mills, grist mills, brick yards and the like, in widely distributed parts of our country.

Absolute Lack of Market would seem one of the last things to be found as the cause of ill success of a manufacturing establishment. But there are instances of just that thing; factories and shops are started in places where there may once have been a market, or there is one, which disappears according to circumstances not merely beyond control but beyond ordinary foresight.

Losses Due to the Product[1] are numerous and varied. They may be caused by either

(1) The manufacturer
(2) The elements, or
(3) The fashions.

These losses may be because the product is

(4) Of too low quality
(5) Too cheap for a spendthrift public
(6) Too dear for the average purchaser
(7) Unsuited to the buyers in question
(8) Old fashioned
(9) Not yet sufficiently advertised
(10) In too many sizes and styles
(11) Too seasonal
(12) Depreciated in quality
(13) An unauthorized substitute.

[1] See also elsewhere.

Product of Too Low Quality. This is a common fault of countries as well as concerns that go after new and relatively unknown markets. They assume that because a certain city, district or country is not used to exactly the brand in question, it does not know what is good; whereas in truth it may be accustomed to something much better. There are still a good many instances of attempts to "carry coals to Newcastle," but the principal difficulty in this matter of low quality is not one of geographical but one of commercial invasion.

As an example I may cite the safety razor. One manufacturer of really excellent goods, backed by aggressive advertising and intelligent service, built up for himself a deservedly highly profitable trade. Almost immediately half a dozen other manufacturers, scenting good pickings, commenced to flood the market with articles of similar use, but the blades of which would neither take nor keep the edge called for by such a device, even were there no competition. The result has been not merely disappointment on the part of the newcomers, but injury to the first in the field.

The same was the case in the early days of bicycles, when gas-pipe frames and malleable iron hubs vainly endeavored to dispute the European field in competition with seamless drawn steel tubes and hubs turned down from heavy solid bar steel.

Product Too Cheap for a Spendthrift Public. The world war developed two classes of *parvenus* for whom few things were good enough, and nothing too good.

In the first class we place the manufacturers, contractors and speculators who, starting with the proverbial shoestring, became, if not "rich beyond the dreams of avarice" (because there is no such limit) at least what with truth might be called offensively rich.

The other class developed in the ranks of so-called "labor" (as though head work was not "labor") having the advantage over the first that there was no 80 per cent war tax on its fabulously increased earnings, and if there had been, there would have been no means of either proving the earnings or collecting the tax. Men who in January, 1914, deemed themselves happy if they had steady work at $2.50 a day, in 1918 demanded $8.00 for much less and much poorer service.

Both of these classes started in a career of extravagance almost recalling "Coal Oil Johnny" and "Champagne Charley" of days gone by. The red-flag-waving mechanic who once sneered at silk stockings as the emblem of a purse-proud, blood-sucking, useless class of society, suddenly found lisle too common for every-day wear, and cotton absolutely unthinkable. His wife, who used to be satisfied with good stout calf-skin shoes, at once appeared in high-heeled white kid. Their typist daughter displayed a diamond ring, went to work in silk dresses and wore an opera cloak in the morning. The 18-year-old son, who used to hold down a job at $8.00 a week, soon drew $18.00, sported a wrist watch, and wore kid

gloves (which he called "kids") in the Subway and on the ferry boats. The janitor living in the basement must have his porter-house steak twice a day.

For all steps of the population except the salaried middle class (the "bur-joycy" of the soap-box orator, who now finds dollar neckties too common) the grade of goods carried must be raised. The brakeman no longer smokes "two-fors" or "Flor del Cabbagio" — he must have Panatelas and Garcia Grandissimas.

Product Too Expensive for an Indigent Population. The oil-cloth business is a good example of a trade which must of necessity make and carry second and third grades — not necessarily "seconds" and "thirds" of a standard high grade, but qualities intended for the East Side in New York City and for Mexico. If high-grade articles and qualities are attempted to be sold in districts and to classes not able to afford them, there will of course be loss.

Product Unsuited to the Special Public. Some localities, some religious denominations, and even some political parties have likings or prejudices that may or may not be reasonable, or sensible, from the point of view of others, including the manufacturer or the merchant who may desire to do business with them. Gay-colored goods would go a-begging in a Quaker community such as Media, Pennsylvania, yet be sought after in New Orleans or in Mexico City. Green neckties might prove intensely popular in Dublin or Cork, and orange-colored in Belfast or Derry; yet who would prophesy success, were the opposite distribution attempted?

Not only in the matter of color or pattern, but also as regards the goods themselves, must suitability be taken into consideration. The poncho and the reboso are suited to the Mexican, but not to the Brazilian or the Argentinian market; — to say nothing of the Canadian. Machetes and cane knives are for Cuba, krees for Burma, and so on. Aluminum cooking utensils are unsuited for Hannover (Germany), and many other districts, owing to the presence in the water of a large proportion of potash, which corrodes the metal. Tubular boilers are less suited than others to certain portions of the State of Ohio, because there the water contains lime in such combination and quantity that it is apt to choke the tubes with a light pumice-stone-like deposit, entirely different from the thin hard scale formed in boilers elsewhere. For the same reason, feed-water heaters for those districts must be of different construction and operation from those which are perfectly suitable elsewhere.

Product Old Fashioned. It would seem an absurdity for a buying public to demand new fashions in articles other than wearing apparel (many think so even in that case.) Yet so-called designers turn out each year new monstrosities, sometimes in such quantities that only one half or less of them will meet with favor in the eyes of the more or less (usually less) artistic or sensible public; and while some markets are more or less sensitive to changes than others, yet in all, even the most conservative, there is a certain element whose *dictum* opens or closes, if not the gen-

eral purse strings, at least those of the greater part of the buying public. The product may be one of a score or fifty years ago, revived after having been pronounced, perhaps with perfect justice, hideous or uncomfortable, impractical or unhealthful; but some second-rate prostitute or third-rate actress, some local magnate, or "sport," or fashion-setting dame may pronounce it "*chic*" (even "chick!") and no other will suffice. On the other hand, good and suitable articles for the same purpose may meet with no recognition and sale.

As many manufacturers carry no stock, but only make up to order, there is more loss and more frequent loss to dealers than to them; but it may happen, where manufacturers do stock ahead, that the whims of fashion, the appearance of a war cloud, the proclaiming of an unexpected armistice, the death of a ruler, may leave them with stock that is more or less unsalable, at least at full price. The automobile maker or typewriter manufacturer who has stocked up preparatory to a whirlwind sales campaign may find himself hit squarely between the eyes by a new rival model, so far superior in real worth, or so much more reasonable in price, that his salesmen have no show whatever. So obsolete stock may fairly be considered as one of the possible causes of loss.

Anything is obsolete that people either can not, may not, or will not use.

Product Not Yet Properly Introduced. It is seldom that any manufactured article is successful en-

tirely on its merits and on being "advertised by its good friends," as the quotation goes. If a product has not been brought to public notice, neither the makers nor the dealers need expect much of a rush demand therefor. And even when the big tam-tam has been beaten and the poster and the full page advertisement liberally used, some things take time to prove their excellence. This is true of safety razors and new brands of hydraulic cement today, just as it was of Bessemer steel and steel rails, high-speed steel tools, and dozens of other articles that today are accepted as a matter of course and standardized for cheap production.

Too Many Kinds and Sizes of Product. I have found some concerns that were turning out too many types and sizes — many more than there was any necessity for. One admitted that he kept on with the long list because he had not the courage to drop any. Yet the occasional loss in turning down a customer who wanted just No. 7½ Acme when a No. 7 or a No. 8 Acme (or indeed a No. 7 or a No. 8 of any one of four or five other very slightly different types) would have been equally good, would have been a mere drop in the bucket in comparison with the expense of carrying so many different styles and sizes — some, indeed, by reason of the infrequent demand, costing the maker more than he got for them.

The losses in this connection are many and various, although not always noticeable at once. Ford has shown that by sticking to one model he can cut down

the unit cost. There is also more difficulty in selling a large variety than a small one, if the small one is good and satisfies the average taste. At first this might seem doubtful; but the experienced salesman will see at once that to handle a dozen widely different styles he must have as many selling arguments; and that where the distinction is but trifling the prospect is apt to wabble from one to another that is but slightly different. Naturally, it costs more to carry a varied stock than one limited in number of sizes and styles; and there is always danger that at the end of the season, or at least of a certain period of time, the manufacturer will be left with some obsolete stock. The dealer faces the same risk.

Product Too Seasonal. A large proportion of the merchandise sold through jobbers is seasonal, usually necessitating on the manufacturers' part one of two expensive alternatives: producing during the whole year at uniform rate, thus losing interest on the flat cost, or laying off workers at one time and hiring them at another — if they are there. If they are not, their successors must be instructed. It is evident that if the entire product of a regular steady run throughout the year be sold for delivery during only one month, an average of about six months' interest is lost; which loss with low-profit goods counts up more than where they are sold at a high profit, hence will stand more risk of non-sale or of bad debts.

Product Depreciated. This may be either

(1) Actually, or

(2) By obsolescence.

Physical Depreciation, as of soft rubber goods, or fruit, naturally hampers or even prevents sales.

Depreciation by Obsolescence, as of type writing machines or automobiles, may find the product absolutely as good as new; yet difficult to sell, even at a sacrifice, as soon as something better appears on the market at a price that appeals to customers.

Unauthorized Substitutes. Here I do not merely mean substitutes that are less valuable than what is ordered, for even if billed at a lower price than the superior grade they might not suit the customer; in fact, sometimes he would take them as a gift. If I order drills with Morse taper shank, I want that taper and no other, for obvious reasons; and the further off I am from the manufacturer or dealer the more I am inconvenienced by the substitution of another taper. There are many instances where the substitution of a superior quality or type, which could be used just as well as what was ordered, has been a source of displeasure to the customer, and resulted in the manufacturer's losing his trade. (Any one who does not believe this may try substituting an "improved" appliance for an old-fashioned one ordered by the United States Navy.)

It is generally safe to assume that customers know exactly what they want, and it is wise to make no unauthorized substitutions.

Shipping Losses may be from

(1) Bad boxing and packing

(2) Too expensive containers

(3) Inefficient containers
(4) Insufficient handling facilities
(5) Inefficient shipping force
(6) Too small lots
(7) Delayed shipment
(8) Inefficient stowage
(9) Wrong choice of carrier
(10) Ignorance of freight regulations
(11) Ignorance of insurance regulations
(12) Ignorance of customs regulations
(13) Wrong route
(14) Damage under way
(15) Loss under way
(16) Theft under way.

Bad Boxing and Packing has two classes of evil results:

(1) Those due to the actual damage to the goods and their containers, and

(2) Indirect losses due to dissatisfied customers, and bad impressions on possible prospects.

Sometimes, indeed, it leads to suits for damages for non-delivery or imperfect delivery.

I will not go so far as to say that bad packing will drive a manufacturer into bankruptcy, but I do know from personal experience — some of it costly — that American manufacturers are the worst packers in the world, especially for export shipment; and that bad packing is the cause of direct loss in that it costs the sender for repairs and replacement, and of indirect loss in that it disgusts customers and drives them willy nilly to other houses.

On the wharf at Vera Cruz I have seen American cases with the strapping ends sticking out nine ways for Sunday — where the straps were not entirely missing — because put on with ordinary carpet tacks. In a New England city I happened to mention to a machine-tool builder that Americans had a bad name in Europe in the matter of packing, and was met with a complacent statement that the firm in question was an exception. Yet on the freight platform in that town I found a case from that concern, with one board loose!

South American importers recently complained of the manner of loading cargoes on steamers. A striking instance was the case of a shipment of flour to Para. It was stowed away among barrels of kerosene and turpentine, being used to pack the barrels snugly. The flour was useless when it reached Para, and had to be thrown away.

While such flagrant idiocy as using bags of flour to keep kerosene barrels from rolling about seldom occurs, yet the same result is found when flour is shipped in vessels which have been used for bulk transportation of fish or of raw hides, especially wet skins.

Too Expensive Packing is that which costs more than its advertising value comes to. From the all-linen rag envelope with copperplate firm name and trade mark, which contains a bill or a price list, up to cases planed inside and out, on cheap goods, much money is thoroughly wasted. The advertising manager is always ready enough to suggest expensive containers; no use in assisting him.

Inefficient Containers are such as may be excellent in themselves and well packed, but of such forms and dimensions that they do not stow well in standard box cars, etc.

Defective Shipping Directions cause delays in delivery; sometimes, indeed, absolute loss of the goods. There are many towns (in South America for instance) of the same name; and if the particular address is not given very plainly in the language of the country of destination the goods may be either carried on too far or unloaded too soon, causing the consignee loss and annoyance, especially where he sends mules or teams from a distance to receive an expected consignment.

Shipping in Too Small Lots naturally calls for higher transportation rates than where car loads or train loads can be sent off at once. The reason or necessity for small shipments may be due to

(1) Insufficient storage capacity on the part of
  (*a*) The shipper
  (*b*) The common carrier, or
  (*c*) The consignee
(2) The nature of the goods
(3) The contracts for delivery
(4) The contracts for transportation.

Inefficient Stowage eats into profits at a great rate, especially on bulk goods. It may be due to either

(1) The containers
(2) The loaders
(3) The goods themselves

(4) The vehicles or vessels.

Unskillful arrangement may be due either to

(1) The shipper's force, or

(2) That of the common carrier.

Its principal effect is increased freight charges; although it may result in delayed shipments (which see).

Insufficient Handling Facilities[1]

(1) Increase the cost of shipments

(2) Cause delays, which often result in

(*a*) Penalties,

(*b*) Loss of further orders, or

(*c*) Extra transportation charges.

Inefficient Shipping Force may have exactly the same undesirable results as insufficient mechanical handling facilities.

Delayed Shipments. The results of these are outlined under "Insufficient Handling Facilities."

Wrong Choice of Carrier. When a "c. i. f." shipment is made by fast freight or express when this is not called for by the customer, or is not essential to the establishment itself in case of its own purchases, money is thrown away.

Ignorance of Freight Regulations may bring an entire shipment under a higher classification than necessary.

Ignorance of Insurance Regulations may make the charges on freight-paid shipments unduly high, by including dangerous materials among those not calling for specially high premiums.

[1] See also under "Planning and Routing."

Ignorance of Customs Regulations may submit the consignee to inordinate import charges, as for instance making him pay for the containers at merchandise rates. Russian bristles in bundles wrapped with heavy twine are a case in point.

Bad routing of shipments was illustrated when a thousand barrels of cement arrived at Para, Brazil, bound for Lima, Peru, via Callao. The latter port happens to be further from Para than the latter place is from the port of shipment, New York.

Wrong Route. This is distinct from "wrong medium."

When I state that goods were sent to me from New York to Dresden, Germany, not merely *via* Bremen instead of Hamburg (Dresden and Hamburg being on the Elbe, and Bremen on the Weser), but *via* Liverpool, I have said enough under this head.

Damage Under Way. As shippers of merchandise "f. o. b." customer's depot never have the same luck in getting damages as do the farmers, who never have any cattle worth less than $400 a head killed on the railway track, losses under this caption are often heavy and annoying.

Loss Under Way includes leakage, meltage and the like, and is sometimes almost inevitable, hence to be allowed for in advance.

Theft Under Way. Losses in this way in America, while not to compare with those on Italian railways, count up; and Government management seemed to boost them.

Selling Losses may be because of

(1) Indefinite offers
(2) Neglect to answer inquiries
(3) Haste to unload
(4) Holding on too long
(5) Ignorance of prices
(6) Ignorance of manufacturing cost
(7) Ignorance of selling expenses
(8) Bad debts
(9) Customers' failure before delivery
(10) Inability to deliver
(11) Drop in the market
(12) Depreciation of goods
(13) Pushing low-profit goods only
(14) Hampered selling force
(15) Unreasonable customers
(16) Ineffective advertising
(17) Selling expenses too high
(18) Hitting the high spots only
(19) Wasting efforts on petty customers
(20) Uninstructed salesmen
(21) Salesmen carrying side lines
(22) No follow-up system
(23) Inefficient sales correspondents
(24) Public buying capacity not fully utilized.

Indefinite Offers do not tend to convert prospects into customers. Buyers like to know exactly what they are going to get, when, on what conditions, and at what price, including all extras, both probable and possible. Yet often they are made such indefinite offers that they do not dare, or do not care, to accept.

Requesting, one noon, a tender for a responsible French house on about $200,000 worth of canned goods, from a prominent New York firm:

(1) The export house was not at the main office, but a mile or so away;

(2) The boy at the information desk of the export office did not know the name of the export manager;

(3) I got as tender a mere scrap of paper, 8 by 3 inches, roughly torn from a waste sheet, with the quotation (in lead pencil) "Today, net, f. o. s. New York, cash against dock receipt."

Even if I had had time to code a cablegram, the cable management could not have got the tender to France before closing hours there that day, which are four hours fast of ours; and the next day they would have been worthless.

How do we Americans expect to do business in competition with business-like European and Canadian firms?

Neglect to Answer Inquiries. Many a sale goes amiss because the manufacturer neglects to send circulars, catalogs, or quotations, when he does not know who the inquirer is. That is just "the milk in the cocoanut." The technical school student of today may be the son of a prominent manufacturer or railway official, desirous of posting himself in advance for duties for which he is preparing himself. The workman of today may be the foreman of tomorrow. Of course, some catalogs are expensive to print and mail; but one never knows what the reply to a request

may bring forth; and when the product advertised is a machine costing $4,000 or $5,000 the manufacturer need not be so chary with printed matter.

Haste to Unload, and its converse, holding on too long, in one sense cause losses in that they fail to realize as much profit, or to come out with as little loss, as if judgment had been better.

Ignorance of Prices. I have known American salesmen to go into a foreign market and without taking the trouble to find out what the local prices were, quote prices as per home instructions. In some cases they lost orders apparently without cause, instead of first finding out what prices prevailed on the spot, and then wiring home for permission to shade. In others they were snapped up promptly, only to find out that later the market would have stood considerable advance.

Ignorance of Manufacturing Cost.[1] The sales department should have some knowledge of what it costs to make the goods; and unless especially instructed to unload below that price, or some other that would afford a profit, should avoid the practise of the apple woman who while she sold below cost, thought she came out ahead by doing such a big business.

Ignorance of Selling Expenses leads salesmen to put time and expenses in working up districts, or in pushing goods, at such a cost for the mere selling, that diminished profit, sometimes even loss, ensues.

[1] See also under "Organizational Causes."

Bad Debts[1] may be due to

(1) The sales department

(2) The credit manager

(3) Bad business conditions.

They are hardly to be avoided; but it is noteworthy that some lines (clothing, for instance) have a high percentage thereof, while others (meat and allied products) get along with almost none.

Customers' Failure Before Delivery does not of course come under the "Bad Debts" caption; but where goods are made to order, especially if not of an easily salable character, the losses here may be considerable. The causes are the same as under "Bad Debts."

Inability to Deliver. When the salesmen have received their salary or must receive their commissions on sales made, whether the orders are filled or not, there must be an entry on the wrong side of the P. and L. account. The inability may be due to

(1) Failure to get material

(2) Failure to get workers

(3) Shortness of transportation

(4) Destruction of the goods by fire, etc.

(5) War conditions

(6) "The act of God."

Drop in the Market.[1] If raw materials drop after goods have been manufactured, it is to be expected that difficulty in selling at the expected price will

[1] See also under "Selling Losses."

[2] See elsewhere under "Commercial Losses."

ensue in such cases as have not been properly covered by contract and security.

Physical Depreciation. Some goods, as soft rubber, depreciate in quality in either very hot or very cold weather; and loss thereon is apt to occur in case of either overstocking, or slack selling.

Obsolescence may occur in many lines — not merely goods dependent on the whims of fashion. Typewriting machines, automobiles and many other manufactures, suffer from this cause.

Pushing Low-Profit Goods. Where there are some goods on which there is a large percentage of profit (those known as "long-profit lines") salesmen anxious to make a big showing and finding that they can turn in large orders for such articles, are apt to consider their own apparent interest and neglect that of their employers. Any one could sell gold dollars for ninety cents in paper — at least under normal and usual conditions.

Hampered Selling Force. In manufacturing establishments and to some extent in concerns doing only jobbing, the selling end of the concern is too seldom posted as to the producing facilities; what is the best paying product; the best paying average weight; — light, medium, or heavy; the best paying glass; — simple or complicated; the most profitable kind of work — (In a foundry, for example, dry sand, green sand or loam; — bench, floor, or machine; the best paying material — gray iron, malleable iron, semi-steel, or steel); also the time required for delivery. Sales-

men may make wild promises in the hope that the firm will make good.

Unreasonable Customers. Some customers are reasonable, some unreasonable, some simply cussed. Machine shops refuse, for instance, to take delivery of castings welded in places where no machining is called for, and where what should be a sharp corner or an edge is a bit rounded, although it is out of sight and the strength of the piece is by no means affected; or where a piece has been burned on. Such customers reduce the profits, but in many if not most cases can be educated and made reasonable beings instead of cranks.

Ineffective Advertising. A good many sales fall to the ground because in their announcements the vendors fail to answer in advance all the questions that experts in the line will be sure to ask, and non-experts will probably put.

Selling Expenses Too High. There can be no hard and fast rule as to the percentage of selling expenses. In the same line they may vary among different houses; in the same concern among different districts, articles and salesmen; also vary not only from year to year but from season to season. In New York City the cost of selling so-called book-keeping machines is much greater on the East Side than on Broadway, because the customers require much more canvassing to make a sale, and more instruction in the use of the machines after it is made.

Among the causes of loss — meaning thereby also relatively small selling profit — are

(1) Too large sales districts
(2) Expensive transportation
(3) High cost of travelers' maintenance
(4) High entertainment expenses
(5) Too little credit given
(6) "Hitting the high spots" only
(7) Wasting efforts on petty customers
(8) Salesmen uninstructed
(9) Salesmen carrying side lines
(10) No follow-up system
(11) Inefficient sales correspondents.

Too Large Districts. "Spreading the butter too thin" may be false economy, as the salesmen can not reach the customers often enough, even where the product is not seasonal. "Intensive cultivation" demands frequent hoeing; but sometimes implies from two to four crops per year.

High Transportation Rates, as in thinly settled districts, or where there is a railway or a steamship monopoly, may cut deeply into profits and even render certain territories non-paying.

Expensive Travelers' Maintenance may be in connection with either

(1) The traveler's luxurious habits, or

(2) Hotel bills (as in Cuba, Mexico, and Central and South America).

High Entertainment Expenses are in some countries and in certain lines of business inevitable; but in many instances entirely unnecessary. The principle adopted and adhered to by A. Wertheim of Berlin,

that no buyer may accept even a cigar from a traveler or dealer, makes for economical purchases; but few merchants or manufacturers are far-sighted enough to make and enforce such a rule.

Too Little Credit Given. I have heard "credit men" boast of having less than say one half of a per-cent of bad debts, when it would have been better policy to have had five; for the simple reason that the merchandise was of the very high-profit class, and if the firm had been less rigid in the matter of credits and still had a large proportion of bad debts, the profit on the rest of the "doubtful" customers would have much more than covered the losses.

"Hitting the High Spots Only" often means entirely neglecting a large mass of customers whose orders might not amount to so much individually, yet who would and could demand less discount and time.

Wasting Effort on Petty Customers may prevent the salesmen from covering the high grade and profitable customers in the field, especially where the goods are seasonal.

Salesmen Uninstructed. Many of us have laughed at the story of the man who, left in charge of his wife's dry-goods store, and being asked the price of mohair cloth, quoted something unusually high, and on the customer's expressing surprise, answered: "Mo's are awfully scarce this year. Two men were down in Maine a whole month and only shot one mo." Yet the same sort of thing happens in different degree in all lines of business; the salesmen do not know the

good and the bad points of their own wares, much less of their rivals'; they are not instructed as to the methods of manufacture, the quality of the materials and trimmings or supplies, etc.

Salesmen Carrying Side Lines. This has the effect of distracting their own and the customers' attention from the main line. At best it may reduce the traveling expenses per trip on each line; but it does not always do even this, as the extra hotel bills may more than counterbalance the decreased transportation charges.

No Follow-Up System. At best the salesman is often but a missionary, and the office may clinch many a scale on which the salesman has done the preparatory work. Or, indeed, it may be the other way about; the office may do propaganda work, of which the salesmen do not promptly and properly take advantage.

Inefficient Sales Correspondents. Many a concern has much better salesmen at the desk than on the road, because such men may be more readily guided by broad general principles applied with due reference to the peculiarities of the goods and of the individual prospect. There are few lines in which there are not more prospects off the paying lines of travel than on; and these should be reached by the seductive home salesman, with his tactful persistence and his knowledge of business psychology. If the home force of salesmen is inefficient, sales will be lost, that otherwise would be comparatively readily and cheaply effected; and all such trade may be considered as "pure velvet."

Public Buying Capacity Not Fully Utilized. Some manufactories have the unhappy faculty of not catching on quickly to public demands, either in their own or in foreign countries. This is partly because they do not keep fully informed as to what is going on even in their own immediate neighborhood and markets, much less abroad; and partly because of hesitation and timidity. As an instance: from the commencement of the second year of the great world war, the South American market might have been captured by North American manufacturers and merchants in many lines; the shelves and bins which had been kept filled by Europeans — and especially by Germans — were empty. The buying capacity of the South American public was hardly lessened; and any preferences for German products, on the part of local dealers, were overridden by the insistence of their customers for necessary merchandise, no matter what the country of origin.

After our breaking off of diplomatic relations with Germany, the manufacturers of American flags might have foreseen a whirlwind of patriotism throughout the land, resulting in an immense demand for the national colors; but this demand was never properly satisfied.

I could multiply such instances ten fold; without cudgeling my brain to conjure them up; every one who reads these lines can think of some, right within his own sphere of action.

In this connection I am reminded of the story of

a man who was stated to have three hands: "two like other people, and *a little behind hand.*"

Transportational Losses.[1] The best factory in the world, making goods that people simply have to buy, loses money if it has not good transportation facilities both in and out. The number of orders might not be diminished (although I doubt it); yet there will surely be losses of time and money due to delays in receipt and shipment, if materials and supplies do not arrive on time and in good condition, and if outgoing goods are held up or switched off to backwoods hiding places, calling for tracers innumerable. The advent of the motor truck has made the manufacturer more or less independent of rail transportation within a certain radius; but receipts and deliveries are seldom unbroken, and rail and canal must be called on to render service.

Transportational losses may come under any one of the following heads:

(1) Monopoly
(2) Unfavorable location
(3) Lack of fuel
(4) Inferior handling facilities
(5) A state of war
(6) Seasonal disturbances.

Transportational Monopoly is of two characters:

(1) Physical
(2) Financial.

Physical Monopoly of Transportation is given

[1] See also under "Technical Causes."

where there is but one line of rail or steamer or canal, and all the product as well as all the raw material must be carried thereby. It exists in many parts of South America, where all goods must be carried on muleback or the like; and in the Spreewald in Germany, where all transportation is by boat on the innumerable intersecting narrow canals.

Financial Monopoly of Transportation needs practically no explanation. It may arise suddenly by either

(1) Consolidation of two or more rival lines of carriers, or

(2) Agreement between them as to rates.

Unfavorable Location. A factory or other establishment on a long narrow peninsula may be hampered by the necessity of shipping all goods towards the root thereof, although their ultimate destination may be exactly in the opposite direction. For a long time the lower end of the State of Delaware was an excellent example of an unfavorable location. The tip of Cape Cod is another.

Lack of Cheap Fuel makes transportation charges high. Where coal or oil must be freighted both in and out transportation, and there is no water line, of if there is, there are few or no sailing vessels, there is a handicap which will be permanent unless the unforeseen happens: as for instance the discovery of coal or oil in the near vicinity.

Inferior Handling Facilities naturally increase transportation charges. Loading and unloading be-

tween vessels and points located on high banks call for cranes, etc. Manhattan Island is abominably hampered in another way; besides shortage of cranes the piers are ill arranged, and access thereto is difficult; while lighterage is slow and expensive.

A State of War naturally increases the cost of transportation because of

(1) Shortage of cars and vessels
(2) Shortage of labor
(3) Increased insurance rates.

The Seasons may influence transportation charges either way. For instance, a hard winter may close rivers and harbors to navigation and block railway lines with snow drifts; either spring freshets or a great drought may stop river transportation.

Manufacturing Capacity not Fully Utilized. For this there is any number of purely commercial reasons, in addition to technical, organizational and financial ones, treated elsewhere under the headings appropriate thereto.

Among the commercial reasons may be listed

(1) Lack of orders
(2) Shortage of labor
(3) Labor too dear
(4) Lack of material
(5) Material too dear
(6) Material depreciated
(7) Picayune policy
(8) Governmental (including State and municipal) prohibition

(9) See also under "Public Buying Capacity not Fully Utilized."

Lack of Orders. Here we revert to many of the causes enumerated elsewhere: "Product too Old Fashioned," "Product too Expensive," etc. But very often the lack is due to an inefficient sales force, which either does not work the ground for all that it is worth, or else overloads the factory with rush orders at one season, leaving it high and dry later. Recently, many manufacturing concerns have taken to offering special inducements for pre-season orders; others again to handling two different lines, filling the year between them, just as coal and ice dealers keep their employees and teams or trucks busy, summer and winter.

Labor Shortage. In what we call normal times usually about twenty per cent of the working force of the country is idle or partially so. This is not necessarily an indication that the workers flock to certain districts, which they overcrowd, and that there is no efficient national employment agency that would make daily publication of shortages and excesses, and arrange for transportation of the excess to points where labor is needed.

Of course, if a plant is built and equipped to keep a thousand men busy, and only five hundred are obtainable, the manufacturing capacity can not be fully utilized. This is entirely independent of the question of labor cost. There are districts where suitable labor can not be had, at least for the special purpose desired, at any price.

Labor too Dear. This is an almost universal cry. The causes are not far to seek:

(1) Demand has been in excess of supply

(2) "Labor" has organized

(3) The "cost plus" system of payment for war orders has offered manufacturers a premium not only on hiring each others' labor away, but even on purposely awarding high salaries and wages in order to increase their profits. Indeed, there are rumors which seem reasonably well founded, that certain "cost plus" contractors deliberately had strikes fomented so as to be "compelled" to grant higher wages, on the excess of which they naturally got ten per cent extra from our esteemed Uncle Samuel.

Lack of Material.[1] Since pre-Biblical days, when the Hebrews in Egypt could not make adobe bricks without the necessary straw for binding, lack of material has caused idle time of workers and equipment. There are times when this, being caused by a state of war, or the act of God, is unavoidable; — but even then, foresight may prevent the wheels of industry from standing still. The manufacturers of incandescent "mantles" for gas burners were prompt in securing a sufficient supply of monazite to prevent them from having to close down during the world war; and other large manufacturing concerns were equally enterprising in respect of other materials and supplies. In some lines, where the materials are not perishable and the fire risk is not specially great, there is always

[1] See also under "Planning and Routing."

a reserve stock not to be touched except in emergency. Here the loss of interest does not count, if the product comes under the "high-profit" classification, and even on low-profit goods in case of contracts for long time delivery of the finished product at a fixed price.

Contracts for delivery of the raw material are all very well in their way, but their way is not always a safe one. Mining companies, even under contract, can not produce if the miners are on strike, the mines are flooded, or transportation is impeded. Penalty contracts seldom cover anywhere near the direct loss due to non-receipt of raw material — to say nothing of the indirect loss due to customers shifting their allegiance, or workers getting other employment.

"Carrying" the employees, even if one has to "carry" only those on yearly salary, during idle time due to lack of material, is often a great source of loss.

Raw Materials too Dear. The introduction of aluminum wares is a good example of the handicap of excellent articles by the high cost of the prime material entering into their manufacture. It is hard to say whether the demand for the manufactured articles stimulated the invention of improved processes for the cheap production of the metal, or the industrial chemists furthered the manufacture of the aluminum articles and set them on their feet. In any case much time and money were spent in the endeavor to push the manufactured product before the sale on a large scale was rendered possible by the cheapening of the raw material — also of methods of handling it.

The introduction of those neat little "snap" devices for doing away with matches in lighting gas stoves was hampered in the beginning by the scarcity of the metal cerium necessary for the alloy used to produce the spark by friction against a file-like steel surface; and the breaking out of the world war practically broke up the business therein.

For the same reason: scarcity of some of the raw materials — the manufacturers of "high-speed" tool steel ("ternary" and "quaternary," metallurgists call them) were badly handicapped at the time when tools of such alloys were most needed by machine-shops all over the world.

It often happens that an expensive raw material is absolutely no better for the purpose then in question than a cheaper one. Sometimes, indeed, the cheaper material (while perhaps for another use inferior) is here the better of the two; in such case its substitution is "indicated," as the physicians say. This often happens with bearing metal, lubricants and fuel.

Depreciated Materials. In this connection I may mention India rubber, one of the few raw materials that depreciate as surely as that 1923 follows 1922; and what applies to the crude rubber is even more true of articles made therefrom. Hence, supplies the principal constituent of which is India rubber, should not be laid in in quantity likely to permit the tooth of Time to gnaw them. This is especially true of soft rubber goods, as driving belts; more so of articles which should be elastic under tension.

Picayune Policy. It may be exact accounting, although even on that score there are doubts, but it certainly was bad business policy for a certain firm that had delivered $400,000 worth of high-profit machinery to one establishment in one year, to send in a bill for "one set screw, $0.03." The recipient paid the bill, — and framed it for display in his office.

It may have been exact business for a printer to tell a new customer that he could not mail him copy and proofs for correction, as it would cost too much for postage. The customer 'phoned him to charge the postage to his account; but after that job there was no more account.

Many an order is lost because a manufacturer thinks an applicant for a price catalog is not a consumer. Every apprentice, every high-school student, and especially every technical high-school student, is a prospective customer.

Prohibition. Against this cause of loss little can be done except to make something else that is not prohibited. If during war time the product be a non-essential, there are usually plenty of essentials to the production of which the manufacturer may turn temporarily. If the injunction bids fair to be permanent, there is nothing else to do but to submit more or less gracefully to the inevitable, and make something else. Brewers can make "soft" drinks or ice; distillers produce pure alcohol under proper supervision; and so on all along the line.

Manufacturing Instead of Buying. A good cost-

ing system and a little gumption on the purchasing agent's part would solve a very important problem at a profit to the establishment — whether to make or to buy certain materials, supplies or component parts. Many a machine shop cuts bolts which could be bought for half the price of manufacture in the establishment; makes crank-handle knobs, and all sorts of parts, from drawings, a few at a time, when it could instead make other things at a profit and buy these parts outside from concerns that make them by the hundred or thousand in standard sizes.

Buying Instead of Manufacturing. Here is the converse of the problem just touched upon. Where certain things can be made as "chink in" work to use up time otherwise idle, it would be best to make them, and thus cut down the loss from idle time, even if they could be bought from outside at a lower price. A good costing system, and a cost clerk and production manager in frequent touch with the purchasing agent, would save many a loss in connection with the problem "to buy or not to buy."

Losses Through Law Suits. It is a sort of by-word that when one goes to law he is out of pocket, whether he gains or loses his suit. There is a good deal of truth therein. When one counts the loss of time alone, the general disarrangement of business and the acrimony engendered (which seldom disappears), one should sue for a very large sum and with a three-to-one chance of winning, before going to law. This is entirely independent of the fact that in many suits costs are not accorded to the winner.

Profit on One Sales District Absorbed by Loss on Others. This occurs very frequently. The reasons for this are covered by paragraphs relating to losses on special products and departments. For instance, the population in Mexico is poorer than that in the United States; that of the East Side of Manhattan than that on Murray Hill or in the Washington Heights district. Again: the latter part of New York City is well known to be populated by *nouveaux riches;* many of them recent graduates of the East Side; hence cheap (i.e., inexpensive) things, although good, may find no sale, while expensive ones, really inferior in quality, find ready buyers.

There are, of course, sparsely settled districts in which traveling expenses are high in proportion to the possibilities for sale; and the distances between customers consumes too much of the salesmen's time, so that selling expenses are double or even treble what they are elsewhere. Contrast, in this respect, Texas, with 265,896 square miles and only 4,663,228 population (i.e., well under 18 per square mile) with Rhode Island, where 604,397 persons live on only 1248 square miles (i.e., 435 per square mile).[1]

Again, in some districts the costs of demonstrating and instructing (say on bookkeeping machines) are much higher than in others. For this line we find a marked contrast between the New York East Side and the Wall Street district.

Profit on One Product Absorbed by Loss on

[1] U. S. census of 1920; none later available at this writing.

Others. Practically the same remarks apply here, as regards causes, as where the loss in one department neutralizes part or the whole of the profit in another. It is merely a question of degree, except that it happens more frequently that there is one losing product than that there is one unprofitable department.

Even in a department showing a profit as a whole, there may be some one or more products turned out at a loss, cloaked by the gains on one or more others. *Per contra,* the losses in one unprofitable department may be caused by some one or two lines, which eat up more than the profit on the others.

This class of loss is found not only in analyzing the profit or the loss on various kinds of articles, but where there are several types of or sizes of any one article. Thus in one foundry, which makes money on comparatively small castings, there may be no proper facilities for handling very large ones; so that it might be better to refuse all orders for castings over some certain weight. In another, making the same line, it might be found that there was money only in very large pieces; so that not merely "chicken feed" but even castings under a hundredweight should be cut out. In still another, there may be a loss on cored castings or those calling for very skilled pattern-makers or molders; while more simple pieces might be highly profitable. Gray iron might pay, while malleable might cause loss.

Profit on One Department Absorbed by Another. We find this set of conditions more in department stores than in manufactories, for three reasons:

(1) There are more lines, hence more opportunities for some departments being, from the very nature of things, less profitable than others:

(2) Just as in the average grocery store sugar is sold not merely at cost but sometimes at an actual loss, as a "drawing card," one or more departments are carried purposely at a loss for purely advertising purposes; attracting the purchasing public (90 per-cent being women, who have less sense of relative proportion than men) to the premises, where they find opportunity and excuses to buy in other departments, where profits are high.

(3) Absence of a proper costing system, so that departments nominally making money, for instance by the percentage of profit over flat cost, are eaten up by interest, insurance, depreciation and proportionate share of rent, on "slow moving" goods, or excessive cost for lighting, floor space, etc., on lines like furniture and carpets.

The same conditions exist, however, in manufacturing lines; sometimes indeed in greater degree. I have known many a works where the core room or the pattern shop was being "carried" by the foundry as a whole; many more where the foundry was conducted at a loss, cloaked by a high percentage of profit on the output of the machine shop working up the castings. We also find machine shops in which the jobbing department "carries" the manufacturing side; more, the other way about.

In a foundry, either the bench, the machine or the

floor molding sub-department might be run at a loss, which if there were a proper costing system, considering each sub-department as a business in itself, would be concealed by the profits on the other two.

Accidents to the Force. Where workers are injured, there is a direct loss through the necessary payment to the injured persons, as well as by the idle time of the latter and of those whose work is either necessarily stopped or hampered by the accident, or who from natural curiosity or sympathy quit their task for a time.

ORGANIZATIONAL CAUSES OF LOSS

The various causes of loss due either to the organization or to the lack of one, may be classified about as follows:

(1) Complete lack of organization
(2) Incomplete organization
(3) Over-organization
(4) Unbalanced organization
(5) Irresponsibility in the organization
(6) Lack of continuity in the organization
(7) Duplication of activities
(8) Division of activities
(9) Oral orders
(10) Wrong attitude of foremen.

Complete Lack of Organization. This is the weak place in many manufactories. They work "any old way:" experienced men do boys' work, and *vice versa;* time of men and machines is lost, waiting for work pieces, raw materials, tools, etc. There is neither head nor tail; neither law nor order. There may be routine, or even a bit of system, but these are widely different from and inferior to organization, as a means of "getting the most of the best with the least," as efficiency has been defined by some Dayton man who knew what he was talking about.

Few industries of any size or importance could be carried on with advantage to product and earnings

if there was not organization of a proper kind to guide the various activities in the proper direction, to coördinate them, and in all things see to it that no moment, no force, no idea, is wasted or misapplied. It is not merely in union that there is strength. A mob may be united in its intentions, ambitions and hopes; but it can seldom attain its wishes unless organization steps in. For this reason those in charge of every industry must be advised that before undertaking to expand they must see to it that their plans are laid and the way of carrying them out afforded by proper organization furnished with the means for working them in the manner and at the time preordained.

In too many manufactories the manager is the financial man; sometimes having inherited the business, of which he has no practical knowledge. In this case he can not even judge correctly of the qualifications of his lieutenants. Yet, instead of having them passed upon by experts, he installs them in office, and expects profitable results. He does not know, and will not admit, that not only typists and shipping clerks, but higher employees, are engaged by important concerns after psychological tests by competent specialists giving them so many points for each one of forty or fifty items of mental and moral equipment; and the more important the position, the more rigid the tests and the higher the standard.

Incomplete Organization. The organization, like the city, that has ceased to grow, has commenced to die. It is then necessary either in outlining a new

organization or in studying an old one for purposes of betterment, to keep in view the matter of completion, up to that point where further change would be, from either the point of view of profit or that of efficiency, undesirable.

In starting, the outline should be made of an organization of definite size to be completed within a given period, with the possibility of still greater enlargement either at the expiration of that period, or before if necessary. In this matter we may liken the work to laying out a system of city streets, or to putting up a building that it is intended to enlarge from time to time by wings or extra stories. Conditions and circumstances, as much as the desire of the builder, determine in which direction expansion and completion is to take place. For local conditions, municipal or other ordinances or the whim of the builder, determine completion with some one material, as brick, or in some one direction, as vertically; and change in either the material or the direction at first planned is apt to be expensive, inconvenient, and unsatisfactory. So with the organization.

Completion, therefore, calls for planning and schedules; and to some extent of records. The plan should be adopted and then the schedule made out, to put it into effect within a given period and by a specified date. The consecutive records of progress will show whether or not the plan has been properly carried out and the schedule adhered to: A diagram of the desired plan being made in fine outline, it is easy to fill

in this with heavy lines, as work progresses; the entire plan being always, however, before the eye. Similarly, the schedule may be laid down both in figures and graphically, and the actual progress compared regularly with that plan.

The successive points of completion should be outlined in advance; and where possible adhered to. For instance, it may be decided, in the case of a concern having several plants controlled by a central office, either

(1) To build up the office organization so as to develop all the plants practically at once; or

(2) To build first some one plant then another in full; or

(3) To carry out one set of improvements in all the plants, before undertaking another set in all.

Which of these three methods is adopted depends largely upon whether the concern is to be managed on the departmental or the divisional system, or on a combination of the two such a working as geographical conditions, the character of the markets, or the nature of the personnel may render desirable.

Lack of Departmenting. No matter whether the term "department" refers to a building, a product or a process, it is desirable that every business of any magnitude should be departmented, in order that it may be readily determined by reference to the cost records and the financial books, whether each department is or is not keeping its end up; also whether it is going down or increasing its efficiency.

Over Departmenting. The division of the establishment and its accounts can, however, be overdone. In the city of Praha (Prague) I found one manufacturing establishment which had 49 departments — by far too many, especially in view of the class of employees who were members of this very complex organization. The concern had been reorganized by a German expert, and the result was disastrous.

Lack of Coördination or Balance. The competent executive sees to it that all the independent departments under him shall operate coördinately — that is, no one shall overrun or underrun another on which it is dependent, or which is dependent on it.

This requires coördination in

(1) Equipment
(2) Working force
(3) Delivery of raw material
(4) Distribution of product.

Lack of Responsibility in the Organization. If the various members of the organization have not had their duties clearly defined and the responsibility of each made commensurate with what is demanded of him there will be continual trouble all along the line.

This has been too much lost sight of. Responsibility should be commensurate with power, and both absolutely and clearly laid down in the records of the concern, and never lost sight of.

Lack of Continuity of Organization. There should never be an interregnum; the death or absence of any member of the organization should never affect

more than momentarily its steady, efficient working. Continuity is more readily secured in a stock company than in a firm, but only there where each member has his understudy to whom from time to time he intrusts his duties, at first under observation, and in minor matters, then for gradually increasing periods and in more important affairs.

Lack of Understudies. The official or employee who has no understudy is a dangerous member of the force; and the danger of being without a substitute in time of need is not confined to the employer, but affects the particular person in question. For if absolutely irreplaceable he stands no chance of being promoted. Imagine a workman in a chemical factory, who is the only one who knows a certain "mix"; what chance has he of attaining a foremanship? The junior bookkeeper or shipping clerk who keeps all the addresses, prices, folio numbers, rates, routes, etc., in his head, saves his employer so much money by not having to consult written or printed data, that it would usually be folly to promote him and replace him with one less capable. A senior can be had from outside, if none be within touch in the establishment itself.

The official or the employee who deliberately makes and keeps himself irreplaceable should use O as a middle initial.

O stands for Ostrich.

Duplication of Activities. Having more than one person or department do the same things seems something that would never be found; yet it is a specialty

of the United States Government, which was discovered by President Taft to have five of its eight departments doing exactly the same thing. In a line organization there is more danger of this than in with the staff system; as with the latter there are experts for each speciality, and each expert works in all departments.

Division of Activities. This is the converse of duplication, and is often found in small concerns where there are not so many heads of the concern as departments or activities. In large establishments there may be special reasons for this division of the work of any one person; for instance, one may be an excellent financier and have a first rate understanding of the sources and qualities of raw materials, hence be admirably adapted as both head of the financial department and purchasing agent; another may be in touch with the sources of capital and withal be a judge of men, hence qualified to take charge of the finances and to hire and fire. But as a rule it is undesirable to give any one person matters to attend to that call for keeping in touch with men and literature in widely differing lines of activity.

Oral Orders cause misunderstanding and loss — often, indeed, bad blood. This is especially true where the workman is comparatively ignorant of the language, or at least of the trade terms therein used in the line in question. Where all orders are written and signed there can be no excuse for carrying them out in any other way than that intended and directed. Written orders have the further advantage that they

place the responsibility for their correctness upon the proper person. They obviate the employment of that well-known species of evasion called popularly "passing the buck."

Wrong Attitude of Foremen. This is a matter properly coming under the head of organization. As a rule, foremen consider themselves as representing the workmen, as against the employer. Having come up from the sand pile or the scrap heap, they are arrayed against what they consider the tyranny of capital. A little diplomacy, coupled with bonuses for output and profits — best in the form of opportunity to purchase stock payable by instalments of wages or even from dividends — works wonders in this particular. But more important still is to make the foremen understand that they are part and parcel of the organization, and as such to be recognized from both above and below.

Manufacturing Capacity not Fully Utilized. Where there is no definite schedule of duties and responsibilities, and red tape and routine take the place of system and organization (from which they are widely different) it will be impossible to use the full manufacturing capacity of the establishment, principally owing to delays, causing idle time, and to doing the same thing more than once, uselessly.

(Non-utilization of full capacity is handled also under the heads of Financial, Technical and Commercial causes.)

LOSSES THROUGH FAULTY ACCOUNTING METHODS

These may be in connection with either

(1) The records, or

(2) The methods of handling them.

They may refer to either

(1) Costing

(2) Commercial bookkeeping, or

(3) The methods of tying the costing with the commercial records.

Records may be

(1) Incomplete

(2) Inaccurate

(3) Imperfect

(4) Belated

(5) Over-complicated

(6) Unadapted to the business

(7) Too infrequent

(8) Insufficiently analyzed

(9) Wrongly applied

(10) Undepartmented.

Incomplete Records are such as omit data more or less essential to full comprehension of the status of the business; as where the foundryman omits recording blast pressure and amount, the dyer the vat

temperature and the period of immersion. They may be compared to a medical diagnosis in which, say, the patient's temperature has not been considered. Many data may not be necessary for every-day use, but at times absolutely essential to proper comprehension of the state of affairs.

Incompleteness of records may be in respect of either

(1) Main elements, or

(2) Subdivisions thereof;

as where the melter records total amounts of coke, scrap and pig charged during the day, but omits giving the amounts and proportions of the individual charges.

Insufficient Records. There are too many establishments where the history of their doings is contained under some one man's hat, instead of being permanently recorded inscribed in the records. No man's memory is infallible; and (with the exception of Enoch, who, we must infer from the Bible, has not yet died) all men are mortal. Hence the necessity of having transactions, prices, costs, etc., legibly entered in the archives, in such shape that they may be consulted at any time, and readily understood when used.

Inaccurate Records are those which while they may or may not nominally give all desired data, present them incorrectly. This may be either inadvertently (as where scales are incorrect, or their records incorrectly read), or with intent to deceive.

Padded Pay Rolls. These, like graft of all kinds,

add considerably to the labor cost of many establishments, especially those under national, State, or municipal control.

Padding is of three sorts:

(1) Carrying the same name on more than one pay roll

(2) Carrying non-workers' names

(3) Crediting workers with more money than is paid them.

Under this heading an amusing story is told of a man at Hog Island, who held down five separate jobs.

Belated Records, especially if in manufacturing lines (as drugs and chemicals), in which there are sudden and great changes in prices of raw materials, may cause loss by misleading in the preparation of estimates and tenders.

Over-Complicated Records may cause loss by hindering, on the part of a manager who is not a skilled accountant, a general insight into conditions and probabilities; hence may mislead as much as if incomplete or belated.

Records Unadapted to the Business may be complete, accurate and simple, yet not present items in the requisite manner. The accountant who would attempt to make and handle the records of a cigar factory or a dye works in the same manner as those for a shipyard would find his time wasted.

Infrequent Inventory. The manufacturing concern that does not keep a so-called perpetual or daily inventory on paper, supplemented by frequent physical

inventories, labors under several disadvantages, among which are: liability to over- or under-stocking, loss from theft, and the inability to show, in case of a fire occurring towards the end of an inventory period, just what was on hand at the time. Insurance companies are apt to contest claims made in December based on inventories made in the same month of the previous year; and the insured can have great difficulty in proving losses under such conditions.

Too Long Costing Periods enable decreases in efficiency to be carried on longer than would be possible if showings were made often. The longest advisable period is one month.

Insufficient Analysis of Records creates the great evil that it permits loss on one or more unprofitable departments or articles to be carried unseen (perhaps unsuspected) by one or more others. From this arises the greatest evil in the foundry business — namely, the flat price on product.

The Flat Price Evil. I have found it almost impossible to persuade some foundrymen that this method is dangerous. I said to one who had a contract for nearly half his total capacity at a fixed price per pound for all sizes and all degrees of complexity: "Have you a contract with the Blank Company to furnish it all its castings?" The answer was in the negative. "Then you are losing; for that Company surely knows enough to give you all the hard ones and let out the contracts for the other easy ones to other concerns at lower prices. But even supposing you

had such a contract; you have no guarantee, and can have none, that the Blank people's orders from outsiders will run the same, all along. If their orders for small sizes increase in proportion, you are liable to lose heavily."

Another concern thought it had solved this problem successfully by adopting a scale by which all castings of ten pounds and under should be sold at so much a pound, all from ten to twenty pounds at so much less, and so on. This was all very well as far as it went, but it did not go far enough. For on examining the time cards on a number of ten-pound castings of different kinds I found some with no cores, some with one, two and three respectively, and one with as many as seven. No one could pretend that all these classes of the same maximum weight but different degrees of complexity cost the same per pound to make, and should be sold at the same pound price.

Undepartmented Records give the possibility of one department losing in efficiency, or even losing money, because the slump or loss is counteracted by the profits on one or more other departments. The finer departmenting is carried, the less liability of one department bearing the loads of another, or of weakness in any one continuing too long undiscovered.

Wide Prevailing Ignorance of Costs.[1] Looking back upon rather a long experience with manufacturers and tradesmen in many branches of industry, and looking about me now, I come to the conclusion that the

[1] See also under "Commercial Causes."

champions in the "don't know" class are foundrymen, printers, painters, plumbers, and milkmen; not ranking in the order named, for that would be difficult to decide, but all entitled to a leather medal. The milkman is perhaps the most ignorant; also the most vociferous in demands for protection by legislation. The plumber does not know, either; but then in the classic language of the street, he "does not care a whoop"; his ambition being to "plumb" your house and then take it in part payment for the job. The printer really deserves my sympathy. The painter used to; but when I contrast the bad work that he is doing in New York with what any sailor man can do any day, my sympathy takes wings.

Visiting about forty widely separated foundries of various capacities, making gray and malleable iron, crucible, converter and electric steel, aluminum, bronze and brass castings, I found that

(1) Few foundrymen had any idea of the total cost of good castings of different weight and complexity;

(2) Fewer still had any notion of the cost of the metal ready to pour;

(3) Few could tell the actual cost of the various direct labor items; fewer still figure, much less distribute, the indirect labor cost.

(4) Many sold castings at a flat price, no matter whether light or heavy, cored or not; and lost on many. Those that cost ten cents a pound to make were sold along with such as cost five, at a flat price of six; and so on along the line;

(5) As to "expense," nearly all were content to throw every peg that did not seem to fit any particular hole, into a basket called "General." Of depreciation, especially by obsolescence, they had no more idea than the child unborn. Not one in ten had sinking funds to replace assets as soon as they became valueless;

(6) Some had no costing system at all.

It would hardly be fair to the average manufacturer or tradesman to place him in the same class with foundrymen, painters, plumbers and milkmen, as regards ignorance of the cost of product or service. But the fact remains that too few know what each job, even as a whole, costs for material, labor and overhead; still fewer what each operation or process thereon costs.

Until such knowledge is universal (say A. D. 2999) the sheriff and his deputies will continue to do the proverbial "land-office business."

TECHNICAL CAUSES OF LOSS

These are legion, and occur where one would least expect them. It would require one good-sized volume to point them out, and three or four to state in detail the appropriate remedies or preventives.

As it is often difficult to say whether a cause of loss is purely, or only in part technical, I shall classify as technical some causes which may be only partly so, and consider them elsewhere, also; making due cross references.

The technical causes of loss may be classified according as they refer to

(I.) Plant
(II.) Equipment
(III.) Planning and Routing.

I. The Plant as Source of Loss. (I use the expression "plant" as referring to buildings, distinct from equipment.)

The losses under this head may be due to either

(1) Location, or
(2) Design (including grouping and construction).

Wrong Location of Plant. If manufacturers would only pay as much attention to choice of location as the United Cigars Company does to picking out good corners for retail stores, there would be fewer failures

among them. For every particular branch of manufacture there are some essential points; while some elements are common desiderata for every branch. To enumerate these general desirable qualities would take up several pages; I shall, therefore, confine myself to treating this topic from the negative side — that is, to enumerating several lacks which cause losses, or at least diminished profits.

(1) Lack of good fuel in the vicinity
(2) Water of bad quality
  (*a*) For steam generation
  (*b*) For brewing, sugar refining, etc.
(3) Water supply insufficient
  (*a*) For power
  (*b*) For brewing, sugar refining, etc.
(4) Distant from raw materials
(5) Transportation facilities
  (*a*) Unreliable
  (*b*) Monopolized
(6) Distant from large consuming population.

Lack of Good Fuel. A certain beet-sugar factory was located in a district where there was no good water and in a State devoid of fuel. Result: too high fuel bill; constant difficulty with the extraction of sugar from the beets.

Bad Water. Where the water contains much lime, it forms a film or scale on the boiler plates and tubes, hence causes excessive fuel consumption; also, unless the expense of reserve boilers is undergone, frequent stoppages for cleaning. In the neighborhood of some

coal mines the water contains sulphuric acid in sufficient quantities to injure the boilers and be undesirable for chemical processes.

Insufficient Water may necessitate shut-downs at times, unless the factory is provided with an auxiliary or emergency steam plant — as has been necessary in Minneapolis and other cities originally relying on water power.

Distance from Raw Materials naturally has two disadvantages:

(1) Increased cost for in-bound freight

(2) Delay in receiving material after ordering.

Transportation Unreliable. This may occur

(1) Where all transportation is by water

(2) Where the railways are likely to be choked by snow.

Transportation a Monopoly.[1] This places the manufacturer at the mercy of a common carrier which may at any time either

(1) Impose practically prohibitory rates,

(2) Grant special rates to rival establishments, or

(3) Be liable to crippling by strike or accident.

Distance from Consumers handicaps the manufacturer by

(1) Excessive out-freight charges

(2) Delays in delivery

(3) Greater liability to interruption of traffic by strikes or accidents; or

(4) Necessity of maintaining stocks of finished material at the centers of consumption.

[1] See also under "Commercial Causes."

Improper Design and Construction of Plant. By this I mean having designs made in the factory itself, by foremen or other non-professionals, instead of having the work done in the drafting room or office, or by competent outside specialists. This applies to both temporary and permanent work. Office employees (at least of the competent sort) have the planning habit, which leads them to attack a problem at the first end instead of starting in the middle and working both ways, or first at one end and then the other. The office or the drafting-room planner is more apt to put to himself the questions:

(1) What is to be done?

(2) What are its elements?

(3) What are the technical means at disposal?

(4) What are the financial limits to the cost of the solution?

The foreman or factory man, however, is more apt to see but one element of the problem, and to hold that so close to his mental eye that it obscures larger and more important factors.

Among the elements to be considered under the head of design and construction of the plant are

(1) Character of the manufacture

(2) Permanence of structure

(3) Probable eventual enlargement

(4) Convenience of reception and storage of materials and supplies

(5) Uninterrupted flow of materials and products

(6) Convenience of storage and shipment of products

(7) Heat, light and ventilation
(8) Kind of power
(9) Fire protection
(10) Local building laws
(11) Character of the vicinity
(12) Materials at disposal
(13) Funds at disposal
(14) Ownership of land
(15) Climate
(16) Employees' health
(17) Recreation and welfare.

Some of these have little or no influence upon profit. Others, again, have either a direct or an indirect influence upon the cost of manufacture, or of distribution and sale.

Character of Manufacture. For manufacturing explosives, for instance, the design must be such that in case of an explosion some portion, as the roof, or some one side, shall be the one to go, and be easily and cheaply replaceable. The old Dupont black-powder mills were built with strong side walls, cut into a hillside. Explosions simply blew off out the front and roof, which were very light. The Squibb ether plant has its sides hinged at the bottom so that in case of an explosion the building would simply open out, doing but little damage. Losses are thereby minimized.

Permanence of Plant. Naturally, design as well as construction must be different for a permanent building than for one only intended for temporary occupancy and use. This will affect matters of general

proportions and dimensions, especially height; also the position of foundations for heavy machinery, and of excavations for vats, piping, cables, and shafting. For instance, for a temporary building there would be little use in carrying shafting underground. Permanent construction for a temporary plant or department causes loss in taxes, and interest on the cost; also losses from the longer time required to get into operation. These are apt to more than offset the items of repair and maintenance; and as for depreciation, practically the whole cost must be written off when the building is destroyed. Insurance might be less than on a merely temporary structure, the degree depending on the contents and the processes.

Proposed Eventual Enlargement should be in mind in preparing the design. With this in view there must be taken into account

(1) Foundations

(2) Walls, columns and piers

(3) Direction in which enlargement is possible or advisable; i.e.,

(*a*) Vertically, or

(*b*) Horizontally.

It will often demand much more solid construction of foundations, walls and columns than would be warranted by the importance of the initial output of product, and profit thereon.

Convenient Reception and Storage refer to fuel, materials and supplies. Many losses are caused by

(1) Demurrage on cars or vessels

(2) Excessive labor cost for unloading

(3) Excessive labor cost in rehandling.

Where a foundry, for instance, has to handle its pig three times and its coke five, as I have seen, the labor bill piles up unnecessarily and expensively.

Flow of Materials. If the design is such that the course from raw material to finished product is either

(1) Broken up by long spaces between production centers, or

(2) Characterized by frequent stoppages, calling for

(*a*) Extra temporary storage space or

(*b*) Extra labor cost for rehandling,

losses will occur; and once the plant is designed so as to incur these, they are liable to be serious and permanent.

Storage and Shipment of Product must be such as to keep down the expense for

(1) Storage space

(2) Insurance

(3) Depreciation of

(*a*) Store rooms

(*b*) Product

(4) Handling.

Otherwise there will be a constant entry of expense, that will diminish profits.

Fire Protection. The fire-protection question often entails enormous expense for insurance, unless taken care of in initial cost: so much so that it would pay better to have some certain products manufactured, or some minor process carried on, elsewhere. An ar-

ticle or a process that would add but one-tenth of a per cent to the dividend might cause half a per cent extra expense.

Oppressive Local Building Laws, calling for unnecessarily solid construction, or limiting the height to which buildings may be carried, can cause excessive expenditure for construction and interfere with uninterrupted vertical flow of materials.

Character of the Neighborhood. I recall two blank-book factories in Hannover which are so solidly and beautifully constructed and so excellently kept in order that they add to the appearance of the residential neighborhoods in which they are placed. Cheaper construction would have barred them from those neighborhoods. The expenses attending this compulsory high-grade construction of course lessen the profits more than the advertising publicity of fine structures is worth.

Materials at Disposal. Where there is no good brick clay, building stone, or construction timber, in the neighborhood or at disposal, the manufacturer may be compelled to build either more expensively or more cheaply than would best conserve his interests. In the first case the losses will be of the kind outlined under "Permanent Construction"; in the second, insurance, maintenance, repairs, and physical depreciation come into consideration.

Funds at Disposal may be insufficient to permit as solid construction as would be desirable, and run up the costs for insurance, maintenance and repairs, and the percentage for physical depreciation.

Ownership of the Land often determined the character of construction. If rented for only a short period this would call for much lighter build than where the land belonged to the factory; hence demand writing off the entire cost *pro rata* for the years of occupancy; as at the end of the lease all fixed assets pass to the lessor. Insurance, maintenance and repairs would be increased by the lighter construction.

Unfavorable Climatic Factors, if not taken into due consideration, may cause losses from excessive costs for heating, lighting, and ventilation, maintenance, repairs and physical depreciation.

Employees' Ill Health can cause loss, whether they work by the day or the piece; such losses coming under the heads of

(1) Reduced output
(2) Lowered quality
(3) Increased spoilage
(4) Increased labor turn over
(5) Increased number of accidents.

Lack of Facilities for Recreation causes losses in pretty much the same ways, although perhaps in less degree, than lack of care for employees' health; as while such facilities may be regarded as works of supererogation — not being called for by law — they make for improved health and for contentment.

II. Losses in Connection with the Equipment. The equipment may be classified in several ways; for instance into

(1) Standard
(2) Special, and
(3) Universal.
Also into
(4) Regular and
(5) Reserve.

Standard Equipment is that which may be employed to perform one operation or class of operations on almost any kind of work piece within its capacity as regards material or size.

Special Equipment will perform one operation or one series of operations on a special product, only.

Universal Equipment comprises that class of machines and appliances which will perform any one of a number of operations (usually but one at a time) on any work piece within its capacity as regards material or size.

Regular Equipment is that (whether standard, special or universal) either in daily use of or all ready for daily use, as installed, independent of either of any spare component parts to take the place of those disabled or worn out, or of the equipment which may be put into service on short notice, either as additional units or as substitutes.

Lack of Regular Equipment is so primal a cause of both direct and indirect losses that it hardly needs to be either explained or apologized for. The principal sources of loss in this particular are

(1) Being compelled to do work on one class or size of machine for which another should have been provided;

(2) The necessity of either turning away or giving out jobs that the plant can not handle.

Where an otherwise well-equipped manufactory has to turn down an order, or provide makeshifts, or send out work, by reason of insufficient regular equipment, and such work is abnormal in kind, dimensions or quantity, the insufficiency should not be considered as a technical fault or a technical cause of either loss or excessive production cost. But very often the needed element is one that in the very nature of things would be likely to be called for more than once, if not at once, and it should have been provided.

Equipment may be insufficient as regards either

(1) That used constantly

(2) Spare production units, or

(3) Spare component parts of such units.

Lack of Reserve Equipment needs little comment other than that found under the head of "Lack of Regular Equipment."

Losses due to the equipment may be in connection with

(1) Power

(2) Machines and appliances

(3) Cranes and the like

(4) Heating, lighting and ventilation.

The Power Question may be resolved into matters connected with

(1) Motors, and

(2) Transmission.

Losses Due to the Motors may be because they are either

(1) Insufficient in number or power, or

(2) Of the wrong type.

Insufficient Power. This applies more particularly to those manufactories which depend on water power, that is a tricky affair; as the gradual deforestation of the land dries up the springs and often leaves the factories practically without water power at certain seasons of the year. The gradual substitution of machinery for hand work naturally calls for more and more power for a given output; and as the factory that never increases the amount of its output has practically started to die, the matter of sufficient power for both present and future demands calls for more than cursory attention and deliberation. Further: in some lines, as flour milling, there is a demand for an increased number of operations for the improvement of the product — and this must be foreseen and steps taken to meet the increased demand.

Shortage of power may be either

(1) Permanent, or

(2) Only temporary or seasonal.

May compel either

(3) Slower machine speed,

(4) Cutting out certain machines, or

(5) Absolute stalling of the entire establishment when heavy work or an extra quantity thereof comes in.

It may be due to

(1) Insufficient coal supply

(2) Inferior coal quality

(3) A dry season limiting the water power

(4) Strikes or sabotage, especially where electric power is rented.

In the matter of water power it may be assumed, in planning the factory and the power equipment, that the time will come when deforestation will reduce the flow at one's disposal, or that other power users will tap the supply higher up; that dry spells will come in Summer, or ice choke the flumes in Winter; so here the rule should be "a little too much is nearly enough."

The experience of flour millers at Minneapolis goes to show that even the Father of Waters may have to be helped out; in fact, in some instances, all the time, by "boiling the water, instead of using it cold." The remedy adopted by the millers to combat shortage of water power from the Mississippi was to install steam engines. Prudent manufacturers who generate their own steam have large coal or oil reserves; the former sometimes under water. Where electric power is used in small amounts, storage batteries may be kept charged, to tide over in case of what would be only a temporary and short-lived break in the regular current supply.

Losses Due to Transmission may amount to from ten to twenty per cent of the power delivered by the fly wheel or its equivalent. As a rule, power losses due to shafting out of line or with insufficient lubricated bearings, or unnecessarily long, and those due to gearing, are underestimated; while those due to loose belts are exaggerated. In any case they can usually be reduced materially at but slight expense.

Losses Due to Machines and Appliances may be caused by

(1) Insufficient supply
(2) Wrong kind or type
(3) Wrong sizes
(4) Too many kinds
(5) Unbalanced equipment
(6) Inelastic equipment
(7) Obsolescent equipment
(8) Equipment not adapted to the work
(9) Lack of spare component parts
(10) Lack of special appliances
(11) Inadequate machine speed
(12) Excessive machine speed
(13) Dull tools.

Insufficient Supply of Machines may be due to lack of capital or to short-sightedness; or may be caused by sudden and unforeseen demand. The result is the same no matter what the cause; — limitation of output, delay in getting some special order done; hence, hanging up delivery.

Wrong Equipment Type. Instances of using the wrong type of machine are where reciprocating appliances are used instead of rotary — the object of the latter being not merely to save time by acting all the time, but to obviate momentary peak loads. This refers, for instance, to circular or band saws as against sash saws; to milling cutters as against planer or shaper tools; to rotary pumps as against single acting, where economy is less important than capacity.

Sometimes there is only "Hobson's choice" as between two appliances already on hand; sometimes, also, there is not much more as regards those to be purchased by the original investment or subsequent purchases of equipment — which leads to the remark that the planner should always have the purchasing agent's ear. The choice of appliances lies not merely between types of machine — as, for instance, between band saw and circular saw — but between different sizes and makes. If it is a question of absolute accuracy, for example, of a long wooden member, the Daniels planer puts in its undisputed claim; if speed, however, is called for, the Woodworth works well enough for almost any job that comes along (and incidentally much better than is appreciated by the average workman who uses its output).

Wrong Machine Size. Manufacturers are apt to buy machines for immediate requirements only; forgetting that the tendency in almost all manufacture is to use constantly larger and larger sizes of motors, presses, etc., and that while a large machine may be used to turn out medium-sized product, a small one can not.

Too Many Kinds of Machines. Where there is an excess of kinds of machines for the same purpose, all equally good, it makes for inefficiency; as the operatives spend time (and often spoil work) getting the hang of adjustments and the like. Any one who has had two or three different makes of typewriting machines (or even three different models of the same

make) in his office, and has noted the annoyances and delays caused thereby in case of a shift of operators, can readily imagine the effect of having in his shop a Smith, a Jones and a Robinson planer of the same capacity; or having his foundry equipped with Brown, Briggs and Branson molding machines for the same class of work.

Unbalanced Equipment. A balanced equipment is one in which each machine or production center can handle the normal output of the one delivering work thereto, and keep the one after it normally employed. There are too few such. Of course there are some, just as there are white elephants and white blackbirds. One reason for their scarcity is the difficulty, in small plants, of getting three single machines of different kinds (especially if made by different concerns) of exactly the same normal capacity. Another reason is, that there are many kinds of machines, the capacity of which depends largely on the skill of the operator. A third is, that one machine of a series may be able to handle more material of a certain kind than the others can, but on another sort of material the relative capacities may be reversed.

In large plants employing gangs of machines, balancing is more easy; one may find three machines of one kind keeping four of the next kind busy, while two of the third can handle what the second set delivers.

In a plant with unbalanced equipment there may be either entire absence of milling machines, or an insufficient number thereof to handle the work that might

be expected as a matter of course in a quantity production shop, or as a tolerably fair probability in a jobbing establishment.

I have known a plant to be overloaded with machines for which no use ever came up; the overloading being the evil consequence of some one on the Board of Directors having either a direct pecuniary or a friendly interest in a manufactory of the superfluous machines.

But that, as Kipling says, is another story.

Inelastic Equipment. The expression "elastic" applied to the equipment of a manufacturing establishment may seem unsuitable; but it expresses my meaning. An equipment is "inelastic," as I express it, when incapable of rapid and easy increase or decrease of output. It is with most plants as with most cities; when they cease to grow they commence to decay and die; and with every plant both buildings and equipment should be so planned and constituted that they can respond readily to sudden demand for either more or different product. This does not necessarily imply increase in the equipment, but such choice of machines and appliances that they can either perform more than one operation, or permit temporary enlargement of capacity. The machinist who removes one side of a planer to take in a railway turntable sector pivoted on another planer or on a window sill, or who bolts on an extra four feet of frame or of bed, or turns a lathe into a temporary miller or boring machine, introduces elasticity into his equipment; and

if he provides extra extension pieces for planers and shapers, and other makeshifts, in advance, he has a more elastic equipment than the one who does not foresee the possibility of having to do a large job on a comparatively small machine, or the converse. The equipment the transmission of which does not permit of running only a part of the machines without running all the shafting in the place, is inelastic; the one that has electric drive, or a small emergency engine or motor, is in that respect elastic. Similarly, the equipment that is not supplied with reserves and spares to use in case of breakdown, is inelastic.

In another sense an equipment may be inelastic: it may not provide for economical running on part output. A flour mill in which the entire equipment is arranged for continuous flow in but one stream is inelastic; but if it consists of two complete components each of half capacity (or better yet of one of five-eighths and the other of three-eighths) it is elastic.

Obsolescent Equipment. It should not be necessary to call attention to the desirability of either selling or scrapping machinery and appliances, even if still good, as soon as there are others that would perform more or better work at increased profit. It must, of course, call for careful calculation of the sale or scrap value of the old machine or appliance and the cost of purchase and installation of its successor; together with the repairs, operating costs and overhead for each. The new must "make good" beyond all question, or its purchase be relinquished.

Of course such substitution is risky, unless the manufacturer has a good costing system and the vendor of the substitute can prove his claims to economy or other superiority. (When it comes to that, almost any manufacturing line, without good costing, is risky.)

Equipment Not Adapted to the Work. This is not the same thing as being out of date. In fact, new equipment may in some instances be either too good for the work, or absolutely incapable of meeting certain requirements. This may be from inferiority, as where a perfectly new lathe has not the backbone or the drive to use the new high-speed cutting tools, or a new "Universal" grinder may not do plain flat grinding economically, or interior grinding at all satisfactorily. A cone or a plate mill for grinding paint or printing-ink might be perfectly satisfactory for black, but absolutely unfitted for vermilion, which as it turns brown readily with the heat of friction, should be ground between rollers.

Lack of Spare Component Parts. Manufacturers usually fail to consider that the loss due to breakage is seldom merely that of the cost of the broken or worn-out component, but the idle time of that particular machine, and of the operatives dependent on the latter.

Lack of Special Appliances. Under this head not merely a chapter but a book could be written. Manufacturing, as opposed to jobbing, offers the best inducement to inventing and using such appliances as, for instance, either

(1) Perform only a special operation, or

(2) Perform more than one operation on more than one kind of piece.

Such appliances are not merely tools for changing the shape or the size of the work piece, but devices for holding it while one or more standard operations are performed thereon.

Unless this lack is due to insufficient capital, or the inability to procure the equipment at any price, or at least at any reasonable figure, this lack is chargeable to the management. The unbalanced plant may be over-equipped for certain operations and under-equipped or not at all fitted out for others.

Inadequate Machine Speed. For every normal machine there is a maximum rate of speed at which it will deliver a maximum amount of perfect product. This rate should be known; if not laid down by its manufacturer, should be ascertained early in its life by its user.

Excessive Machine Speed may and often does cause loss of material where the operative can not feed fast enough or sufficiently accurately to have the material properly acted upon. The spoilage in punching work sometimes amounts to five per cent, from this cause only. In some instances this excess of speed is that due to the rate fixed by the manufacturer of the machine itself, or to the impossibility of changing the rotation speed of motor or shafting. It may, however, be the fault of the planning department; or of the speed boss, where there is one.

Dull Tools.[1] Lack of frequent tool grinding (preferably according to standards for rake, etc., and done by others than those using the tools) decreases the output per time unit, hence increases both labor cost and many other undesirable elements; and where spare sharp tools are not ready to replace dulled ones without necessitating any waiting, the result is still more unprofitable.

It is remarkable that a machinist who would not think of shaving without first stropping his razor will start a new job with the unsharpened tools left over from the last one. Experiments go to show that even with the best of tools either the amount of material removed per time unit with a given horse-power decreases, or the amount of power per unit of material removed per unit of time increases, with the time during which the tool is used.

Lack of Cranes and Other Means of Local Transportation causes

(1) Excessive cost for unskilled labor to transport pieces

(2) Delays in getting out work

(3) Delays in shipment

(4) Accidents to unskilled and other workers.

Insufficient Heating is apt to numb the hands, hence lessen the output and increase the amount of spoiled or defective work. Where the floors are cold, as where they are of cement or iron, the workmen get cold feet in the literal sense, and contract rheumatism.

[1] See also under "Planning and Routing."

Excessive Heat lessens the vitality, especially where there are no cooling drinks to refresh the workers after undue exertion. There are, of course, occupations where great heat is unavoidable; but in these cases means should be provided to mitigate the evil, and especially not to compel the workers to go home in sweat-laden clothes in icy cold weather. It is strange that the proverbial "merciful man who is merciful to his beast" is not merciful in at least the same degree to his fellow-men.

Insufficient Ventilation naturally reduces the workers' vitality and good will, hence results in decreased output and an unnecessary amount of spoiled stock. Also, it is the cause of many days lost to the employees, which is apt to disarrange the program and the routing, especially where the work is done by gangs or groups, each member of which has a pre-appointed duty, and is accustomed to working in only one place in the team.

Excessive Ventilation (meaning drafts) causes rheumatism and dangerous colds on the workers' chests; the natural result being decreased output — to say nothing of discontent on the workers' part, and abnormally large labor turnover.

Insufficient Lighting causes diminished output, poor health of the workers, and an abnormal amount of spoilage.

Unscientific Lighting is an entirely different thing from insufficient illumination. Light too strong in places prevents careful measurements and detection of

faults; while sudden gradations from brilliancy to shadows cause accidents to life, limb and property.

III. (A) Wrong Planning and Routing. This is a very general and very constant source of idle time, hence of loss. The delays and idleness due thereto run from slight ones such as a workman having to wait for tools to be delivered or sharpened, to hours of waiting for a machine to be disengaged, or for the product of one operation to be delivered for subsequent handling. Alleged humorists in the newspapers poke fun at the plumber who waits for his assistant to go back to the shop to get a turnpin, or a shave knife, a bar of solder, or a nipple; but the plumber is not the only one who sits around waiting on account of bad planning.

This source of loss due to idle time can of course be eliminated.

Improper shop routing is one of the most common causes of delays in production, hence reduction of the capacity of the plant and consequent increase in the percentage of overhead to the other two principal cost factors. This delay is often, also, the cause of dissatisfied customers; hence leads to loss of future orders. Improper routing is sometimes the cause of increased labor cost per unit of product.

There is room here, indeed, for a large book, which, however much I would like to write it, I must add to the thousand and one things which must probably be left undone.

Planning and routing have reference to

(1) Processes employed
(2) Their sequence
(3) Sequence of the jobs
(4) Time of commencing each job
(5) Duration of each operation
(6) The appliances used
(7) Direction of work flow
(8) The operatives assigned.

Putting it another way, we may say that planning and routing refer to

(1) Material
(2) Labor
(3) Processes
(4) Product
(5) Amount of output
(6) Power

and take into consideration

(7) Time
    (*a*) when
    (*b*) how long[1]
(8) Position
(9) Movements, with respect to
    (*a*) number
    (*b*) combination
    (*c*) sequence
    (*d*) speed
(10) Dimensions.

Material Loss Through Bad Planning and Routing may be in connection with

[1] Irrespective of speed.

(1) Design of product
(2) Choice of material
(3) Lack of material
(4) Waste of material
(5) Non-utilization of scrap
(6) Non-utilization of by-products.

Improper Design. Where the draftsman is not familiar with pattern-shop, smithy and machine-shop operations, he may indicate for castings or rough forgings such dimensions as may well cause unnecessary removal of material; i.e., he may call for taking off too much "flesh." In the case of expensive material, for instance high-speed steel, that goes into scrap. The pattern maker or the molder may occasion a loss of 40 per cent in gates and sprues, where proper gating might call for only 20 per cent or even less.

Faulty Choice of Material. There are instances where the choice of too cheap material causes not only increased labor cost by reason of the longer time and the superior class of labor required to work it, but increased spoilage owing to hidden flaws or to the worker's ignorance of the material's special peculiarities. Using more easily worked material even at higher cost, thus avoiding excessive spoilage, is seen in both the wood-working and the stone-working industries. A "sweet-cutting" wood or a flawless and homogeneous marble saves not only labor cost but the probability of the entire material being wasted, should the wood develop knots or the stone show internal fissures or "hard hearts." Sculptors have heart-breaking

experience in this respect — where, for instance, a statue must be abandoned or pieced because a dark streak develops under the chisel, just across a face.

Lack of Raw Material may be either

(1) Original

(2) Temporary, or

(3) Eventual.

Original Lack of Material.[1] I recall the establishment of a beet-sugar factory in Delaware, where there were no proper contracts with the farmers to deliver beets; and another in Illinois, far from coal and water. It goes without saying that neither of these was, or could have been, successful. Other similar factories, suitably placed as regards raw materials, declared dividends the first year, and kept it up.

Temporary Lack of Raw Material hit many a factory on both sides of the Atlantic at the outbreak of the war. There are also other causes of such lack for a time, as strikes, failure of transportation, bad seasons, etc.

Eventual Lack of Raw Material causes disaster to many an industry — as, for instance, smelting plants, oil refineries, brick yards, etc. American lumbermen — who are manufacturers when they operate saw mills — know what exhaustion of raw materials means to them. That it is largely their own fault for having pursued the same robber policy towards our great forests that the Virginia planters followed towards their fertile acres, and the Pennsylvania coal

[1] See also under "Commercial Losses."

miners towards rich coal deposits, is a matter apart; the fact remains, that there comes a time in certain industries in which freights and distance from supply of raw material play an important rôle; and from that time losses inevitably occur.

The absolute disappearance of the American flax-spinning and linen-weaving industry is due to the disappearance here of long non-branching flax fiber suitable for spinning. To produce this, the seed must be sown close together; but the only present flax sowing is done widely, to produce stems with many branches, producing seed as the main object. American manufacturers dependent on the supply of fiber for spinning lost money gradually, but at increasing rate, until finally they had to close out. Cotton is now king here.

Excessive Use of Materials. This is more common in contracting and building than in manufacturing; but exists also in many lines of the latter. In house carpentry where twelve-foot boards might be called for, the purchase of fourteen-foot lengths involves waste in the shape of two-foot ends, of which but few can be used anywhere. Similar waste occurs often with joists, scantling, and the like. Where used in large quantity they could just as well be ordered either of exact desired length, or of such dimensions as would occasion minimum waste. Foundrymen who have a coke-to-iron ratio of only one to four sin or err in this respect. Painters waste material by mixing too much.

Excessive Wastage may be the result of wrong

equipment, as where re-sawing is done with a circular saw instead of with a band, resulting in double the quantity of waste material in the form of kerf (and incidentally, increased power consumption). But it may result from improper design, or careless workmanship, or handling. The draftsman who leaves too much " flesh " to be removed by machining, the bricklayer who makes too many half bricks, because too lazy or too stupid to pick up those already at hand, the foundryman who handles the coke five times between car and charging floor, all increase the bookkeeper's red-ink consumption.

There is a historic anecdote, no doubt founded on fact, of a machine shop with windows giving on a canal, into which latter spoiled pieces were thrown surreptitiously. When the canal was emptied and dredged, a brass mine was discovered. This could have been possible only where there was no control of unfinished castings issued for machining; and of work in process. This lack of control cost the shop not merely cash and reduction of output, and possible delay in delivery; but through the temptation and opportunity afforded, reduced the workmen's moral sense.

Whether it is leather or shirting, lumber or boiler plate, a skillful cutter will effect a great saving in the way in which he lays out his work so that what is left over as scrap, useless for the purposes of the manufacture in question, shall be but a very small percentage of the entire surface. Here increased labor cost often saves itself over and over in decreased material cost.

Excessive Consumption of Supplies. From petty matters such as the stenographers in the office using letter-heads as cuffs, and envelopes as drinking cups, to the machine shop where new files are used in cleaning castings, waste of supplies goes on daily aggravatingly and expensively. The sign "Hands must not be washed with machine oil" which confronted me in a machine shop in my boyhood, provoked a smile; but where that sort of thing takes place from one end of the establishment to another, unchecked, it is no laughing matter for the proprietor.

Just as supplies can hardly be charged to a particular job, so the exact consumption necessary for an output varying in kind and amount is difficult to predetermine.

Non-utilization of Scrap. When I say "scrap" I do not mean solely pieces cut off in manufacture, but by-products as well. In many businesses the former scrap or waste products are now the main output. "The stone rejected of the builder is become the chief cornerstone." It may surprise many to know that benzine and cement are such products; during the war glycerine was also. Non-utilization of scrap is peculiarly American. The French and the Germans understand and practise scrap-using "from A to Izzard." There are isolated instances, for example the meat-packing industries and the cotton-oil manufacture, where utilization is carried quite far in America; but take it by and large we are only beginners in this line. The Germans build special factories to utilize

the waste products of so-called main industries; in many cases these produce much larger revenue than those from which they sprang. If you don't believe it, consult the prices of dyes and some of the drugs manufactured from the coal-tar series.

One of the most glaring instances of non-utilization of by-products of which I have knowledge was in Maine, where a beet-sugar factory threw all its *cossettes* or spent beet slices, into the bay; although as food for cattle they had the same cash value, ton for ton, as the beets from which they were made.

Theft of Stock (either raw or made up) is clear loss; often not merely direct but also indirect in that the loss is not discovered until too late to replace the stolen articles for work that must be done either at once or not at all.

Shrinkage in Stock Rooms. Under the head of "Shrinkage" we may call all sorts of decrease in value, rather than in bulk or weight. Leakage and evaporation of liquids make a hole in the profits; but so does the deterioration of rubber goods kept too long on hand and especially under either too warm or too cold temperature.

(B) Labor Losses through Bad Planning and Routing. Labor may cost too much per unit of product for any one or more of planning or routing reasons; for instance:

(1) Wrong workers assigned
(2) Design too complicated

(3) Wrong operation or process
(4) Workers' capacity not fully utilized
(5) Lack of reserve workers
(6) Material too difficult to work
(7) Saving material at the expense of labor
(8) Insufficient appliances to save handling
(9) Tools dull
(10) Operations too often repeated
(11) Too small lots
(12) Night-shift work
(13) Too short work hours
(14) Idle time
(15) Insufficient inspection
(16) Unnecessary local transportation
(17) Unnecessary moving of heavy work pieces.

Faulty Assignment of Operatives. The planner should keep in constant touch with the shop foremen in order to learn which men are enduring, which ingenious; which will follow instructions absolutely literally and which invent improved methods and appliances; which are the best planer hands and which "can run a lathe with their eyes shut." Although the individual assignments are made by the foremen, it is well for the planner to know whether a sufficiency of the class of operatives desired for a particular job will be at the foremen's disposal at the time in question. If not, it may be desirable either to postpone the job or to shift some men.

In the initial stages of our taking part in the world war, much bad judgment was exercised by drafting

machinists and chemists to act as doughboys, generally, and then having to depend on breaking in shoemakers and women to do machinists' and chemists' work. That misfits and misassemblages took place, and caldrons and drying pans blew up, was the natural, inevitable, regrettable consequence, against which all united in protesting. We are not, however, in many branches of work much more sensible in seeing to it that beefy men are chosen for heavy work and quick-fingered for that demanding what is wrongly known as dexterity (dexterity consisting in using the right hand, while the quality of using both hands alike is ambidexterity).

There are racial differences which qualify men for different kinds of work; thus the Irishman is a good excavator, the Frenchman has the best fingers, and so on.

Workers may be

(1) Too expensive
(2) Unskilled
(3) Incompetent
(4) Uninstructed.

Too Expensive Workers, like the converse, is a matter calling for calculation; taking into account the factors of

(1) Rate per hour
(2) Production per hour
(3) Spoilage
(4) Oncost (burden; expense; overhead).
(5) Effect on other workers.

It is evident that where a skilled worker at $6.00 a day can deliver only twice as much product per hour as an unskilled one at $2.00, on bench work or other work not calling for factors of interest, taxes, repairs or maintenance, and depreciation on the equipment, as well as rent for floor space occupied, the change from unskilled to skilled would certainly not pay.

Should, however, material cost enter into the question, and the skilled labor spoiled much less than the unskilled, thus effecting a saving both of labor and of material, — or even where the material had practically no value, or the work done was labor only, like hanging doors or aligning shafting, and much of the work of the unskilled employee had to be done over again, spoilage must be taken into consideration.

Where labor and material are the only important factors, the problem is again different from such cases as call for a high percentage of "burden" or oncost in the form of

(1) Interest, taxes, depreciation, repairs and maintenance on equipment, and

(2) Rent for the floor space occupied,

the problem of skilled versus unskilled labor becomes further complicated.

Unskilled Workers[1] (meaning laborers) no matter how intelligent, may cost, at least at first, much more per unit of product than if skilled operatives had been assigned. So where it is not "Hobson's choice" care should be taken to avoid costly loss of time (implying

[1] See under same title elsewhere.

not merely wages but reduction of output and delay in delivery), extra inspection charges, and spoilage.

Incompetent Workers. In these days when a janitor or a bootblack can arm himself with a hammer, a saw, a Union card, and a five-dollar bill, and get a job as ship carpenter, the chances that the manufacturer will have no incompetent workers to cut down his profits or even cause a loss, are rather slim. This incompetency is largely due to the lack of a proper system of apprenticeship; failing this, to the absence of any instruction as to how to do work and how not to do it.

Uninstructed Workers.[1] When Taylor, who had never piled pig iron, taught huskies how to do that work more rapidly and with less fatigue, and when Gilbreth, who had never laid bricks, instructed masons how to increase their capacity without tiring themselves so much as when they worked their own time-honored way, both manufacturers and workers began to "sit up and take notice." It is now quite well accepted that proper instruction in almost any line of industry is to the advantage of both employer and operatives.

Lack of proper instructions keeps down the output per worker (labor loss!) and increases the amount of spoiled and defective goods (material loss!). Instructions should be in writing; and the worker should read them aloud to the foreman or other authority and sign them as indicating that he has read and understood

[1] See under same title elsewhere.

them. Non-English-speaking workers should receive less pay per unit of time for a given work, than those conversant with the spoken and written vernacular. From the sociological standpoint, also, preference should be given to English-speakers, especially if citizens.

Design too Complicated.[1] This may and usually does increase labor cost for

(1) Production

(2) Assembling.

Wrong Process.[2] Any one who has had to paint a gas holder or the side of a wooden barn in cold weather by hand, with a brush, will recognize at once the superiority of a spray apparatus for such work at such time. Automobile builders have long ago given up hand work for chassis painting; a plunge in the tank "does the trick." Galvanizers (so-called) learned only a few decades ago that in passing a long strip of sheet iron through a bath of melted zinc not only was the iron coated with zinc from the bath, but the latter gradually impregnated with iron from the sheets; so they adopted the method of blowing pulverized zinc on to the surface of red-hot sheets. And so on, all along the line of manufacturing industries; processes are being discarded as ineffective, or inefficient, or both.

Workers' Capacity not Fully Utilized. This has nothing to do with the question of skilled or unskilled

[1] See under "Losses in Connection with the Product."

[2] See also elsewhere.

labor as usually understood. It means that the full capacity of neither trained workmen nor "huskies" is utilized properly; that is, in such manner as to enable them to get out the maximum of work with only normal fatigue of muscle and nerve — thus utilizing the doctrine of efficiency, which demands maximum effect with a given effort, or what is the same thing, a given effect with minimum effort.[1]

For each human being, considered simply as a machine, there is also a maximum rate of speed for each operation on each kind of material. This speed should be learned by experience with various workers, and used as a standard both for output demanded and for pay accorded per time unit. The German "Morgen" was an amount of land that could be plowed in a morning; and so on with numerous other former standards of measurement.

Lack of Reserve Workers. It may not be necessary or even desirable to have reserve workers on full pay; but it may prove highly advantageous to have some within reach, so that they can jump in and supply the place of any one disabled or unexpectedly absent. This is especially so where the shortage would be in a gang that could not operate advantageously, or perhaps even at all, if short-handed. An analogy would be that of a five-masted schooner where the loss of only one "A. B." seaman overboard would be seriously felt if the cook were not also capable of lending a hand in the emergency.

[1] See my work on "Personal Efficiency," published by Macmillans.

Material too Difficult to Work. This may be because it is either

(1) Too hard

(2) Too irregular in structure

(3) Too irregular in composition;

so that it calls for

(1) More skilled labor

(2) Longer duration of the work

(3) Absolute loss of labor if the piece is spoiled.[1]

Saving Material at the Expense of Labor. Purchasing marble which develops streaks or cavities after the workman has got well into the mass, or buying lumber which had been too rapidly kiln dried, so that it is smaller at the ends than in the middle of length, and must be re-edged, may cause an expense for labor, outweighing the saving in cost of material.

Insufficient Handling Appliances.[2] Imagine a car-wheel lathe or grinding machine without a crane. The old-fashioned methods of temporary runways, or ordinary block and tackle, consumed wages and delayed operations.

Dull Tools.[3] In one sense this is a matter of equipment; but it is the planning department's duty to see to it that all tools are kept sharp, and that no job is commenced without the operative being furnished with a full set thereof, sufficient to complete the job without stopping to get tools sharpened. Dull tools increase the duration of the job and often spoil the finish;

[1] See also under "Material Losses."

[2] See also under "Shipping Losses."

[3] See also under "Losses in Connection with the Equipment."

and they decrease the output of the plant and retard delivery.

Unnecessary Repetition of Processes. This refers usually to so-called thermal processes, but more particularly to those in the manufacture and processing of iron and steel. As an example of loss in this connection I may mention first running melted iron from the blast furnaces into pigs, which at some later period are remelted in the cupola, to make castings. Many grades of coarse castings — gas and water pipes, for instance — can be poured directly with blast-furnace metal, thus saving the expense of melting, and incidentally that of re-handling; and in some cases considerable interest on the value of the pigs.

In the steel business much loss used to be occasioned by first allowing the ingots to cool, and later heating them for the blooming process. Nowadays, they are either "bloomed" at once, or at least put into soaking pits, in which they retain sufficient heat to enable further working without additional heating.

Too Small Lots. Timidity often causes a manufacturer to order and put through lots of only ten, where it would cost but seventy-five per cent more for labor to get out twenty; and so on. Reducing the thing to the utmost limit, we can see that the time spent in requisitioning, ordering, assigning workers and machines, instructing, setting up and breaking down machines, and heating cupolas, crucibles, tempering vats, etc., is the same for one article as for a hundred. Just where profit must be sacrified to

caution should be a matter for careful calculation and study.

Too Many Short Jobs may cut down the earnings of an establishment by preventing the workman from learning to do jobs in the best possible manner and the least possible time. Long jobs invariably call for a certain time for the operator to "get into stride," after which he can rip things out at a paying rate, thus increasing the output of the establishment and decreasing the labor cost per unit of product. In addition, short jobs are apt to have an unduly high proportion of spoilage.

Night-Shift Work. While this often has the effect of keeping down the ratio of oncost to direct labor charges, partly by increasing the establishment's capacity, partly by reducing the interest charges on work in process, partly because the night gang (especially in foundries, where night work is usually shaking out and cleaning) is composed of cheaper labor than the day shift, yet where the wages per hour are excessive and the insufficient lighting, etc., reduce the number of units of product per hour, night work may cost more than it comes to.

Overtime Work. As a rule, this costs more per unit of time. Even where all is on a piece work basis, there comes in the matter of extra inspection, lighting and heating, and where the work is done by the hour, the output per worker and machine per hour is usually less, or the quality is poorer.

This matter of overtime must be weighed up against:

Too Short Work Hours.[1] Naturally, if the plant runs and earns only during seven hours, while all the fixed charges run twenty-four, the seven-hour day increases the overhead percentage, and diminishes the output of the plant, with a given number of workmen. The theory that the seven-hour day as a substitute for the eight gives eight men work instead of only seven is all very fine; but we must consider in connection therewith that eight operatives and their families must be supported instead of seven; and that the introduction of the seven-hour day invariably brings eight men, instead of only seven, who demand the so-called "living wage" and "minimum wage." Further: the eighth man is not always attainable.

The work-day length, while not within the planning department's control, has much to do with the planning, especially where there are jobs of cylinder-boring and the like, which may not be interrupted without spoiling the work irreparably. The only advantage of short hours comes in where there is not enough work to go around among all the workers in the factory community, and shortening the time keeps more on the spot ready to start in when times are better.

Idle Time may be occasioned by any one of a great number of causes, as for instance

(1) Waiting for work
(2) Waiting for tools
(3) Waiting for machines
(4) Waiting for power

[1] See under same heading elsewhere.

(5) Waiting for instructions
(6) Lights out
(7) Insufficient inspection
(8) Unnecessary local transportation
(9) Unnecessary moving of heavy work pieces.

Waiting for Work is the result of either too few orders or bad planning. In any case it is a double loss — that of the time of man and machine, and of the establishment's earning power.

Idle time of men and machines is often the sales department's fault (or its misfortune, to put it more kindly; for sometimes sales simply can not be made). It can also be that of the planning department, for not so arranging that as soon as one job is finished another is ready to be started. It is hardly fair to jobs on hand to charge them with "their share" of the loss by idle time; for this would result in over-charging or over-estimating. So the best way is to consider that the sales department is doing its best for its own sake, and to keep in touch with therewith so as to plan and rout scientifically, and thus keep the whole idle-time account down to a minimum.

Waiting for Tools is just as bad as waiting for work, but can have but one cause — bad management. Tools, jigs and the like should be ready for each job before it is commenced.

Waiting for Machines is in the same category, and results from the same cause, as waiting for tools.

Waiting for Power may be due to an accident, or caused by bad management in that the fireman, for

instance, is not held responsible for having a full head of steam when the starting whistle blows.

Waiting for Instructions shows bad management and nothing else. The instructions regarding a job should be ready long before it is given out.

Lights Out is a condition usually caused by accident; causes idle time all the same.

Insufficient Inspection at each important stage of the manufacture is likely to increase spoilage and the cost for labor and material, due to the fact that work is done on already defective pieces of material, and such work is of course practically thrown away. The output is lowered, which increases the overhead percentage — if only a trifle. We must not neglect trifles; a million is made up of ones and twos.

Goods that slip past, after a "once over," will probably be caught somewhere by customers, and returned at the manufacturer's expense for freight and a large part of the flat cost. In some lines he may be lucky if he does not have to pay damages for delays, wasted labor, or accidents caused by defectives. This is entirely independent of the loss of orders caused by the manufacturer's damaged reputation.

Unnecessary Local Transportation. There are factories where partly finished products are carted or carried here and there "from pillar to post" without due reason — just because the building happened to be badly planned, or the equipment badly placed, or the routing was unpractical. This transportation consumes unnecessary time and space, and costs money;

for in some lines of work it is accompanied by either a certain amount of danger to the workers, or deterioration of product, or both. Straightway flow of material and product is always desirable from the points of view of simplicity, safety and economy.

Time waste in core-making in foundries, for example, as ordinarily practised, is considerable, and continuous from bin to bench. Time is spent in wheeling sand sometimes up to 100 feet. Then dumping and shoveling the dry sand sorts four feet high into the mixer takes, say three minutes; mixing, five; shoveling into two barrows (a mixer full), three. So we have the mixer busy only about 44 per cent of the time. The binder is added later. Further time is often wasted by compelling the core-makers to carry their cores to the ovens; sometimes, indeed, to do the baking. Lane found this in one instance to amount to a thirty-mile walk per day and back, core-makers' time being used instead of laborers'.

Moving Heavy Work Pieces. It would seem ridiculous, hauling a heavy casting a hundred feet or so, to bring it to a drill press, when it would be much cheaper and just as practical to bring an electrical drill to the work piece.

This is entirely independent of the matter of improper placing of equipment causing unnecessary transportation of work, whether heavy or light.

Losses in Connection with Operations or Processes. Among these we may mention those due to

(1) Wrong operation

(2) Wrong sequence of operations
(4) Wrong time of commencing jobs
(5) Excessive duration of operations and transit
(6) Miscellaneous causes.

Wrong Operation or Process.[1] The list of instances in which the cost of production per unit has been reduced by substituting one operation for another would cover much paper. One of the best examples is drop forging, where at one blow between dies the same or a better effect is produced, and by unskilled labor, as would otherwise call for long and skilled manipulation with various hand tools. Die-casting, so-called, is another instance where a permanent mold replaces a succession of specially made ones each producing but one casting, and being destroyed in the production. The use of the "air brush" (which is not a brush) instead of the ordinary hand brush is a good example of such substitution. The milling cutter, operating on comparatively great widths of work, instead of the planer or the shaper tool, is another; the chaser for forming several turns of a screw thread at once, instead of the V tool for cutting one only, is still another. Finally, the substitution of casting for forging, in making complicated tools of high-speed steel, is an excellent example.

Wrong Sequence of Operations. In chemical work there may be a choice as to the order in which the various operations are performed, as for instance whether to separate mechanical impurities by filtration

[1] See also elsewhere.

before eliminating chemical ones by precipitation. In machine-shop practice it is sometimes more convenient to plane before milling, sometimes the other way about. The choice of sequence may be purely technical, or it may be financial; and there may be cases where purely financial reasons outweigh those which are solely technical. The planner must decide whether labor cost or interest on investment is the more important.

Where there are two operations on a job, one of which costs more than the other, and it is immaterial from the technical point of view which of the two comes first, that one should precede, which costs the least, and is the more profitable, so as to reduce the interest charges for the labor expended.

This is a matter seldom noted, and comes under the ken of the planning department.

Wrong Sequence of Jobs. The great war brought this aspect of planning very prominently to the fore. Where nine jobs out of ten were either for our Government or for some other with which our interests were closely bound up, the question of preference as between governmental and strictly non-governmental jobs was easy to settle; but there were few strictly non-governmental jobs. All roads led, not to Rome, but to Bordeaux or Liverpool; so that "Rush" and "Preference," "Must" and "Priority" clashed at every turn. The planner often had to give an apparently trivial job preference in sequence either because so many lives depended upon it, or because being once out of the way, the road would be clear for a long line of

really weighty matters. Traffic agents had nothing on shop and factory planners in the way of work and worry, rush and responsibility.

The good shop planner sees to it that where possible there shall always be one job in hand, another all ready to take up, the moment the first is finished, and pipes laid for a third to follow the second; and this mental chess-playing with himself applies not only wholesale, in reference to the entire factory or department, but to each man and productive center. Otherwise the idle machine and idle man items would bank up on him.

I am not sure but that I would recommend giving the planner a bonus on elimination of these two items.

Delay in Making Repairs is a proverbial cause of loss. "For want of a nail," etc. Of course there are instances, as in the production of war material, where the work can not be stopped to make proper repairs, sometimes even to make any; but such neglect is apt to cost enormously. I know of cases where at the close of the war all the machines in a plant had to be scrapped, without exception. They had been "held together by wire and string," as the owner said, just to enable them to turn out screws and the like incessantly. The more the repair bill is kept down by such delays, the greater the percentage which must be written off for physical depreciation. As a rule, money and time spent in repairs more than pays for itself in reduced physical depreciation. (It can of course have no influence on depreciation by obsolescence.)

Repairs During Work Hours, however, go to the other extreme, because they effect a stoppage not only of the work on the machines themselves, but elsewhere. In fact, the attention of the other workers being drawn from their own legitimate occupation, demoralizes the entire establishment.

Too Much Dead Work. By "dead" work I mean that which involves merely foot-pounds of energy, whether exerted by man power or by machinery. All work employed merely in conveying either materials, men or work in process is "dead," as opposed to that which performs an operation tending to carry the work piece or material a step forward towards the state of finished product. Good technical oversight and planning reduces this to a minimum by shortening the total ultimate distance from receipt of raw material and supplies to shipment of finished product, and the total foot-pounds expended in transportation through that distance.

Wrong Time of Commencing Each Job. Merely to assign the proper time may be comparatively easy; but to see to it that before the arrival of the set time all the materials, supplies, machines, operatives and instructions are decided upon and their readiness arranged for, is quite another matter. These necessities are what make determination of the time of commencing each job (when that is not fixed by priority claims, but is left to the planner's discretion) doubly difficult. In any case, a time must be set for the curtain to go up and the stage to be set for the play at the appointed time.

It is evident that to carry in one's head all the various times, with their endless combinations, would be a hopeless task in an enterprise of any magnitude; especially in one of any degree of complication. The blackboard and the planning sheet must be called into play, so that no factor may be forgotten, no unnecessary duplication ensue, no undue complication take place.

Excessive Times of Operation and Transit may be due to

(1) Faulty grouping of production centers and units
(2) Wrong machine speed
(3) Unnecessary delay between operations
(4) Lack of instruction of workers.

Faulty Grouping of Production Centers and units is considered elsewhere; but it is of such importance that I cannot refrain from taking it up here. It is not sufficient to have constant flow of material in and product out, to save time and increase capacity, nor that distance may be practically annihilated by conveyors which lose no minute in delivering the product of one unit to the next in manufacturing order. It is desirable, also, that the various production centers shall be so grouped that there can be personal touch between the various foremen and operatives, so that any undesirable variation in quantity or quality of output of the one can be reported thereto at once by the next in order.

Improper Machine Speed. There is an economical limit to the speed of every machine; in the type-

writer, that at which the most skilled operator can work an hour at a time without brain fag or tired finger muscles. In the printing press it may be the rate at which white sheets can be fed in without too much electrical disturbance, or printed ones folded without tearing. In almost every machine the greater the speed the greater the expense of wear and tear, the liability of spoiled product, and the burden or overhead of all kinds. This supposes, of course, that the working hours remain the same; as when a machine does ten hours' normal work in nine, then rests an hour for lack of work, the annual charges for interest, insurance, etc., remain the same. Operators' wages depend on whether the work is paid by the hour or the piece; in the first case there is wage saving by high speed; in the second, not.

Unnecessary Delays between Operations have for their drawbacks that they

(1) Block gangways and storage places
(2) Make production irregular
(3) Reduce the output, hence
(4) Increase overhead percentage.

Uninstructed Workers[1] cut into dividends with a big ax. The lack of proper and timely instruction

(1) Delays production
(2) Increases overhead percentage
(3) Increases spoilage and wastage
(4) Increases inspection cost
(5) Increases number and cost of accidents to life, limb and property

[1] See under same heading elsewhere.

(6) May lead to dissatisfaction of customers, hence loss of trade.

Insufficient Preliminary Studies. Manufacturers are apt to be over-confident and to imagine that if they can conduct one line of business satisfactorily and profitably, they can jump right into another and make an immediate success. Lack of preliminary study may lead to taking up a line for which the plant, the resources or the personnel are absolutely unfitted, or which would have no chance of success even under the most favorable manufacturing conditions.

Lack of Production Control. This control, while essential, is almost impossible without a well-balanced and well-knitted-together organization, permitting the unbroken current of orders as well as the uninterrupted flow of material and of work in process. Without a proper system of production control, preferably graphic, the following classes of loss-producing causes are possible:

(1) Excess of stock necessary to be carried

(2) Delay in getting work instructions, supplies, materials, tools, etc.

(3) Excessive overhead

(4) Excessive labor cost

(5) Decreased output

(6) Imperfect inspection.

No Follow-up System for Workers. The relations between employment bureau and worker should not cease with the assignment of a definite job at a definite price; but be continued methodically and con-

stantly by a follow-up system serving to check the accuracy of

(1) The bureau's judgment as to the worker's
  (*a*) character
  (*b*) general ability
  (*c*) fitness for the job in question.

(2) The worker's statements as to his own
  (*a*) character
  (*b*) general ability
  (*c*) fitness for the job.

(3) The foreman's judgment as to the worker's
  (*a*) character
  (*b*) general ability
  (*c*) fitness for the job.

(4) The efficiency of the shop training methods as affecting the worker's output.

Losses in Connection with the Product.[1] With reference to these losses from technical causes, we may consider:

(1) Quality too low
(2) Design too complicated
(3) Product unstandardized.

Quality too Low. While this may be because the management has purposely ordered cheap material or cheap and hasty workmanship, it may be also that good materials have been spoiled in handling; for instance where ignorance of hardening and tempering produces poor tools from good steel, or lack of knowledge of proper vulcanizing methods spoils the best of Para rubber.

[1] See under "Commercial Causes," and elsewhere.

Design too Complicated. Complication of design may be viewed from two standpoints:

(1) The number of pieces of all kinds

(2) The number of kinds of pieces.

Some typewriter manufacturers, for example, call attention to the great number of pieces, others to the great number of kinds of pieces, in their rivals' machines. Both great number of pieces and great number of kinds thereof increase the cost, particularly of assembling.

The Ingersoll watch ("the one that made the dollar famous") is a good example of simplification; the ordinary cylinder escapement watch is much more simple in design than the lever escapement type; the alligator wrench than that called after its inventor, the late Thomas Monkey.

Unstandardized Product may be in respect of

(1) Quality

(2) Design, or

(3) Dimensions.

Unstandardized Quality increases manufacturing cost by calling for repeated measuring and mixing of batches, determination of temperatures, etc., prevents quantity production, and calls for carrying more raw and finished stock than would otherwise be necessary. There was an American steel maker whose steel was always better than the best English, but sometimes only a trifle better, at others a good deal better; so that as the hardener never knew "where he was at," the brand in question was condemned as no good, when the sole difficulty was that it was not regular.

This lack of standardization may refer to either

(1) Intentional or

(2) Unintentional

variety of characteristics.

Unstandardized Design has the same undesirable effects upon manufacturing and selling costs, hence on profits, as unstandardized quality. The only exceptions might be in such lines as carriage manufacture, where wealthy customers order direct of the builder, and are particular to have their own different from any other, present or past.

Unstandardized Dimensions prevent quantity production and call for carrying in stock an increased amount both of raw material and of finished product.

Losses in Connection with Amount of Output. These form an interesting class, which may be subdivided into those due to production being

(1) Excessive

(2) Insufficient

(3) Irregular, and

(4) Inelastic.

Excessive Production either may or may not be a cause of loss, according to circumstances. It may be due entirely to the planning department, or to piece-work operatives doing their best to secure plump pay envelopes. It may be on account of the size of the machines or to their speed. Many a foundry has had to turn away work on account of excessive size of molding machines; paper mills have had to refuse countless orders for less than say five tons, being a day's run of the mill.

Insufficient Production. As when digging a well it is best to dig down to a good supply of water; so in running a factory, the output should be pushed up to the limit at which it can be disposed of to outsiders or used in the establishment itself.

The limitation of output, with its consequent excessive overhead percentage, may be due to either commercial or technical causes; for instance to

(1) Too short working hours

(2) Inefficient methods generally,

among technical causes; and to many others which are treated under "Commercial Causes."

Too Short Working Hours[1] naturally limit the output and increase the overhead percentage. That workers can produce as much in eight hours, much less six, as in ten, under similar conditions, is a fallacy easily disproved by the fact that they do it every day in industries where the standard time is eight hours. After working eight hours at regular rates they keep on from one to four hours more at time and a half. While they do not perhaps turn out so much work per hour in this extra paid time, they certainly prove two things irrefutably: that ten hours is not too long for a man to work and keep sound and well, and that more work can be turned out in eight hours than in six, in ten than in eight.

Limited production is due to many things, among which may be casually mentioned

(1) Idle time of machines

[1] See under same heading elsewhere.

(2) Idle time of workers.

(3) Lack of production control

(4) Lack of records of production time per unit of product.

Irregular Production may be due to causes beyond the control of the planning and routing department, or it may be (and usually is) its fault. It has the effect of hampering the accuracy of cost calculation, as the percentage of the three main elements vary too greatly. It may be due to the sales department ordering more or less than turns out to be advantageous; or to the purchasing department laying in perishable stock which must be manufactured in order to save it; or too little of one material compared with the supply of another on hand or newly purchased.

Inelastic Productive Capacity hampers the establishment in that it compels it to turn out just so much, irrespective of the prospective markets for purchase and sale respectively. This is especially the case in automatic manufactures with continuous flow, where the speed of certain machines (in the case of flour mills the reels and middlings purifiers) can not be altered either way without more or less damaging the product.

Inefficient Methods Generally naturally run up the cost of product. To enumerate them here were to write a special book. Many of these inefficient methods are handled separately elsewhere.

Power Losses. Improper planning in connection with power leads to such losses as

(1) Excessive peak loads, with accompanying low duty, and sometimes involving

(2) Stalling of the work, with consequent idle time. (See under this head.)

(3) Lack of load at certain hours, with attendant low duty

(4) Necessity of running overtime, with consequent increase of labor cost per unit of product.

(See also under "Equipment.")

PERSONAL CAUSES OF LOSS

Losses Due to the Personal Element. We may divide these in the first instance into those due to

(1) The management
(2) The workers, or
(3) Both, considered as human beings.

Under each of these headings we may consider them as relating to either

(1) Quantity, or
(2) Quality.

Quantity of Personnel either directive or operative, may be either

(1) Excessive
(2) Insufficient, or
(3) Badly proportioned.

Excess of Numbers in either the directive or the operative force naturally increases the pay roll; often at the same time decreases the efficiency by hampering the organization. Very little need be said under this head. As a rule, the excess is not among the operatives.

Insufficiency of Numbers may be found in either the directive or the operative force, also. Losses through this are usually due to limitation of output, although sometimes the shortage may be in only certain lines.

Badly Proportioned Numbers give the disadvantages of both over and under-manning. Some will be paid for time which they can not profitably employ; others discontented because over-worked — at least in comparison with the unnecessary ones. The proportion of the different kinds of workers, whether in office or in shop, should be such that every man is kept busy by some one or more in one direction and contributes his due share to keeping one or more busy further along the line.

Personal Causes of Loss may be classified again into those which

(1) Are purely individual
(2) Concern groups or masses.

Purely Individual Causes may be either

(1) Inherent or congenital, or
(2) Acquired.

Inherent or Congenital Causes may be either

(1) Mental
(2) Moral, or
(3) Physical;

and either one of these may be

(1) Positive, or
(2) Negative;

Also either

(3) Remediable, or
(4) Irremediable.

Inherited Mental Causes are such as result from

(1) Lack of original brain power
(2) Defective nervous organization, or
(3) Injurious habits.

Just where the line between cerebral and nervous affections lies, I am unable to say. As even alienists differ, I am safe in "hedging."

Inherited Moral Causes have been shown by distinguished investigators to be the almost inevitable concomitant of criminal parentage, and even of atavism, leading to criminal impulses; i.e., striking back to a criminal type beyond the immediate parent or parents.

Inherited Physical Causes are usually the result of insufficient or improper nourishment of parents.

All three classes of inherited causes are partly of our own bringing; partly the result of the neat little economical habit that the German and other Governments had, before we blocked it, of sending their criminals and mental and moral defectives to our hospitable shores, instead of jailing them or providing asylums for them; partly to assisted or even voluntary exile of "bad eggs" and "black sheep" belonging to respectable European families.

Mental Defectives naturally block the progress of the plant by being in the way of others, or by malcomprehension of orders, causing actual damage.

Moral Defectives, like rotten apples in a barrel, spoil those about them. They lower the tone of the working force, even when they do not carry on active harmful propaganda.

Physical Defectives, like those of weak mental power, may either clog the human machinery or cause actual damage; besides which, in some lines they

themselves are in more danger than sound workers, of injury to life and limb.

Lack of Education, like mental defects, shows its evil effects in noncomprehension of orders, and in the inability to make suggestions calculated to improve processes or products.

"Wrong" Education is a vague expression, but is somewhat distinct from lack of education in that it is more difficult to combat; as bad mental habits must first be overcome; and man being only "a bundle of habits," as one writer puts it ("mostly bad ones," another asserts), the old and faulty ideas must be eliminated while proper ones are inculcated.

Misleading Education. To let a human being grow up without education is a pity or a sin, according to circumstances; to mislead him by deliberately inculcating false doctrines is both a sin and a crime. If I were to dare to define the "sin against the Holy Ghost," I would call it "debauching the soul of a person or of a nation."

Each of my readers may make such individual application of this, as occurs to him.

Losses Due to Managerial Qualities are much more numerous and considerable than those caused by the quantity of the directive force. Managerial inefficiency (extending clear through to foremen and gang bosses) may be due to

(1) Native incapacity
(2) Ignorance
(3) Inexperience

(4) Undue conservatism, or

(5) Over-progressiveness.

All these faults are independent of the question of salary.

Natural Incapacity may be in connection with

(1) Technical matters

(2) Finance, or

(3) Handling men (which some authors confuse with "manhandling," which the dictionary would show them to be a rather different thing).

When we come to consider the question of functions of the managers as laid down, for instance, by an important American corporation, we will see that incompetence on their part can act on those under them like weakness or balkiness of the wheel horse on the rest of a team. Among their activities are "to exercise general direction and supervision of the government and administration of the operating organization, and be responsible to the Executive Authority for the efficient, economical and profitable operation of the Company." This provision carries with it "power to organize and compensate, standardize and correlate, supervise and differentiate, as among the units into which the organization is divided."

That "the apple can not fall far from the tree" is an old and homely proverb, applying alike to national and other governments, armies and business organizations.

Competence is usually less readily secured and held in a stock company than in an ordinary firm, as

changes in ownership usually occur more frequently in stock companies than in firm membership; and very often new directories introduce new policies, which while in themselves perhaps as practical as the old, nevertheless have the same effect on the business as sudden changes in the line of goods made in a factory — they demand breaking down the machinery and setting it up again.

There are employers and managers who would ruin the best body of workers ever assembled; largely by lack of consideration; but sometimes indeed by truckling to unjust and gradually increasing demands, instead of putting the foot down flat.

To be a good employer one should be born with rather more than the average amount of the milk of human kindness, yet have plenty of hard common sense, so as to be able to distinguish between just and unjust demands; between large and unimportant issues. Above all, the employer must be square. He must have a sense of proportion. He must exhibit in himself the qualities which he demands of his workers. If he is inconsistent, if he makes rules, even just ones, and does not enforce them, he will be imposed upon. If he makes unjust regulations, even his just ones will be considered as unfair; and the workers will take the ground that anything is justifiable that will beat the boss.

Prof. James has rightly said that the average man utilizes only one fourth of his physical and one tenth of his mental capacity. Yet manufacturers seem not

to realize that while one truck driver can get more out of a dray horse, and one chauffeur more out of a motor truck, than another, the same differences of efficiency in getting the most out of their own personal equipment exist among all the other members of the personnel; and that analysis, practise and the imitation of efficient models would eliminate many a loss.

Ignorant Management. A manager may be experienced — that is, long in service in the line in question — yet too deficient mentally to be able to grasp problems properly and solve them satisfactorily; in other words, "not bored out big enough" for the position.

Ignorance may be in any one of the three directions indicated under the head of "Capacity"; also may be sub-classified under any one of those into ignorance of

(1) Oneself
(2) One's business, and
(3) One's rivals.

Ignorance of Oneself. The Ploughboy Poet's "wad some power the giftie gie us, to see oursels as ithers see us" hits the psychological nail on the head. Every manufacturer has some valuable qualities, developed or latent, which he should know; and some weaknesses that it is even more important to discover and conquer. Otherwise, although there may be profits, they will be less than if self-analysis were keen and thorough.

Ignorance of the Business. This would seem as improbable as inexcusable; yet I could put my finger

on a dozen large establishments where the one most interested confined his researches to watching the stock quotations. At one time there were thirteen millionaires' sons at Altoona, learning the practical details of the railways which in all human probability they would inherit. Two of them later absorbed, and saved from utter wreck, other railway kingdoms, the crown princes of which had confined their useful energies to bob-sledding and polo.

Ignorance of One's Rivals. Krupp von Bohlen, the husband-manager of Bertha Krupp, said that one half of success in business lies in knowledge of one's rivals. This does not necessarily imply spying; but does call for careful study of the rivals' plants, equipment, personnel and product, and comparison with one's own. I have seen a steam-engine builder sell an engine to a paper manufacturer under guarantee of "better regulation than any other made," only to be confronted with the fact that across the river engines were governing down to one and a half per cent, while his could not do better than two and a quarter. The rival product should never be x, the unknown quantity. If worse, the manufacturer should take advantage of that fact; if better, he should learn why and seek to equal, if not surpass it.

Foch won his last offensive by knowing exactly what Ludendorff intended to do; where, and when. He was therefore not only prepared with sufficient defensive forces and reserves to break down the attack, but had also his own plan for an attack in case the proposed

Ludendorff offensive did not come off according to schedule. This is merely an illustration of the truth of the statement that ignorance of one's rivals is a cause of loss. Ludendorff was ignorant of Foch's knowledge and plans — hence, was beaten.

Inexperience differs somewhat, if only in degree, from general ignorance. A man may be well posted as to the regular line of work in the manufacture under consideration, yet have no experience in new, or different old, problems; hence may fall down really through no fault of his own, from inability to grasp the new, or the different old, conditions. His experience may naturally be in connection with either

(1) His own problems, or

(2) Those of his rivals.

As an example under either one of those sub-heads, a manager may be entirely competent to manufacture standard woolen goods, yet inexperienced with shoddy; fully able to buy or to sell in domestic markets, yet inexperienced in export or import; used to managing Americans, yet absolutely inexperienced with Mexican laborers.

Undue Conservatism has wrecked many an establishment. It is usually accompanied by or caused by undue confidence on the part of the manager in his own ability and that of his predecessors, and unwillingness or inability to see good in anything proposed by others, particularly of the younger generation, or educated elsewhere than in the establishment in question. St. Paul's counsel, "Prove all things, hold fast that

which is good," is not heeded by the manager, who will wreck the concern eventually, unless it is one of those "must" businesses, that is absolutely indispensable.

Conservatism, especially in the matter of publicity, keeps down manufactories, that with a reasonable amount of appropriate propaganda would declare good dividends. It is all very well to say with Ralph Waldo Emerson that if you make a better mouse trap than any one else, the world will wear a pathway to your door. But there are paths of various widths and depths; and what is of more importance, of various lengths; and the mouse-trap manufacturer who does not advertise will most likely have only short and narrow paths leading to his door.

Undue conservatism is hard to define. If a manager succeeds by following the beaten track, he has not been unduly conservative; but if he makes a failure by not "keeping up with the procession," he has been an old fogy. It depends on the man, the methods, the line of business, the general and local conditions,—and luck.

Over-Progressiveness may be considered on exactly the same lines as over-conservatism. One man, who succeeds by daring, is considered a genius; another, even less enterprising, makes a failure and is rated as a wild-eyed theorist.

Over-progressiveness leads the manager to "prove all things," indeed; but whether good found or shown to be bad, to drop each one and try something else, without stopping either to analyze the probability of

success of the new or to appreciate and utilize the advantages of the old.

Uninstructed Department Heads. In many establishments there is no certain means by which each department head is informed exactly as to what he is to do, and how; and in many instances there is no method of insuring that after department heads have been so informed they remember their duties and carry them out; to say nothing of seeing to it that they advance with the times.

Office Force Incompetent. We run across this every day and at every turn. One bookkeeper can perhaps average a hundred entries daily, where another can make only seventy; some typists can write a hundred average letters to others' seventy, and so on.

Here the fault may lie with

(1) Our American slap-dash way of "training" office employees

(2) Incompetent managers who do not know good work from bad, or

(3) Our lack of proper methods of selection and promotion.

In Europe, the young man who intends being, say, a bookkeeper, or a salesman, undergoes what amounts to an apprenticeship that may last four years, during which time his salary is "nothing the first year and double that the second." But when he has got through, he writes a hand like copperplate; knows the details of the business in question, and is so generally grounded that he could accept a similar position in an entirely

different line of business and in short time show efficiency therein. He probably attends night school and learns typewriting and stenography, and at least one foreign language well enough to correspond therein. The probability is that if he can afford it he goes abroad as a volunteer, to perfect himself in the language, and incidentally pick up some special trade secrets; after which he is fully equipped to render good and efficient service in the chosen line, or to take up some other in which his attainments will find a good market. Then we Americans wonder that the foreigners get the business!

The office manager should know what constitutes normal work; incompetent employees should be shown that they are paid for work, not for mere presence in the office.

Office Force too Expensive. This is rarely the case in the sense that any one employee gets more than he should, but rather often, in that there are too many employees who have time to sit around and gossip. There are of course both badly-paid and overpaid employees; but my experience is that the salary, compared with the service, is more often disproportionately large than too low.

The personnel should be paid largely by performance after test; promotions should be as frequent as possible where justified by performance.

Improper Assignment of the personnel soon makes its evil effects evident. Placing a square peg in a round hole, or as it has otherwise been expressed, put-

ting a right-handed man in a left-handed position, is seldom at all successful; never so much so as if each person's qualifications were duly investigated and tabulated, and assignments made on the tabulation basis.

Losses in Connection with Quantity of Operatives. Here we have not only the same subdivisions as employed in connection with the directive force; namely those due to

(1) Excess,
(2) Shortage, and
(3) Bad proportion;

but to these may add a fourth and very important one:

(4) Excessive labor turnover.

Excessive and Insufficient Numbers have already been mentioned as causes of loss, whether among the directive or the operative class. I may only add that

Over Manning eats into the profits. It is of course risky to be short of workers when an important order is received suddenly; but with proper correspondence between the sales and production departments and the hiring bureau, the safety excess may be kept down to the minimum; while

Under Manning naturally tends to increase the overhead percentage, and decrease the output, by not utilizing the full capacity of plant, equipment, and directive force.

Bad Proportion of Workers may be in respect of

(1) New hands
(2) Minors
(3) Kinds of races
(4) Kinds of branches of work.

Too Many New Hands. Where there is an undue proportion of new hands, even where they are skilled in the trade in question, there is usually diminished output, owing to either

(1) The new hands not knowing where persons and things are to be found, or

(2) The processes being of a different kind or coming in a different sequence from what they have been used to, or

(3) Increased turnover, especially where the "cost-plus" system is in vogue in the neighborhood, so that there is constant change of hands.

(This matter of turnover will be discussed a trifle further on, in considerable detail.)

Too Many Minors. The old saying, "two boys are half a boy, three, no boy at all," applies to some extent in a factory, where boys are also apt to annoy the adult workers. It is hardly reasonable to expect that a boy shall have the same ambition and incentive to work and to learn to work that an adult has, — especially where his wages are taken away from him by his parents. With girls, although the attractions of the ball field, the swimming hole and the fishing wharf fail, still they have the movies and other things to distract their attention; and as a rule they expect to get married anyhow, and drop factory work; so "what's the use of learning?" Once married, if compelled to work in the factory, they often see the stern necessity staring them in the face, stay where they are, and do a full day's work, "in that state of life in which it hath pleased God to put them."

Too Many Races of Workers. Where there is a single worker of different race and language from his fellows, he is apt to feel like the proverbial cat in a strange garret, and let his mind wander from his work. This decreases output and increases spoilage and accidents. Also, he is more readily enticed away to another place where he can speak his own tongue and be welcome. This increases turnover.

Where the different races are somewhat equally balanced there is a tendency to staging a modified Donnybrook fair on Saturday nights. Even Sunday mornings offer churchgoers of different races and religions both opportunity and excuse for rioting. I have known Hungarian Roman Catholics to blow up their own church because the rector was a Pole.

Bad Balance of Branches may result in the greatest degree of inefficiency. A marked example was at Hog Island, where on some ships the riveters' efficiency was only about fifteen per cent. Working on one hull there were too few bolters: no riveter gang can work ahead of the bolters. On another ship there were too few heaters and tossers: and naturally, no riveter can head up rivets that do not get to him.

Excessive Labor Turn Over. In connection with quantity of operative force I may take up as one of the greatest sources of locc, labor turnover; that is, the constant coming and going of workers, causing

(1) Increased labor cost per product unit
(2) Decreased output
(3) Lowered quality of product

Excessive turnover takes place

(1) Among new hands

(2) With unskilled workers

(3) Among the ignorant

(4) With the unmarried

(5) With the childless

(6) With minors

(7) In unattractive jobs

(8) With workers of different language from the majority

(9) With workers of different race from the majority

(10) With workers of different religion from the majority

(11) With strangers to the locality

(12) In inclement seasons

(13) In strongly Unionized localities

(14) (Seldom, however) where local liquor laws are too lax

(15) Where local liquor laws are stringent.

New Hands get discouraged because they do not earn so much as the old timers; because of frequent reprimands, and because there is a large and increasing class of workers who will be new hands all their lives.

Uskilled Workers [1] quit for about the same reasons as new hands.

Ignorant Workers leave partly for the reasons cited for new and unskilled hands, and partly because

[1] See under the same heading elsewhere.

they are more readily incited to quit by agitators. They do not comprehend orders, either oral or written, so well as those who have more education; do not suggest improvements in process or product; and are more likely to harbor fancied injuries, and susceptible to the jaw carpenter's wiles.

Unmarried Workers naturally have less to tie them to one town, or even to one employer, than married ones. As a rule, they have less incentive to earning than benedicts, hence are

(1) More apt to absent themselves unnecessarily,

(2) Less apt to exert themselves at piece work,

(3) More liable to quit for a job elsewhere, even though it brings no apparent betterment.

In addition, they are generally less comfortably housed and well fed; hence in poorer physical condition than their married co-workers of the same age and occupation.

Childless Workers, like the unmarried, feel less obligation to stick to a certainty.

Minors have less ambition and fewer needs than adults. As in many instances their pay is taken from them by their parents or guardians, "they should worry." At most, the boys may receive a thrashing at home, if they quit work.

Unattractive Jobs (of which there are many, and of which few establishments do not have some), naturally are dropped much more readily than "puddings" or "fat things"; and even more willingly than average ones.

Workers Ignorant of the General Language, no matter what it be, are shut off from fellowship and companionship, even if there be no real antagonism. The more ignorant they are, the less easily they learn to understand their fellow-workers and to make themselves understood by them.

Workers of Different Race from the majority, even if they understand the language, being apt to be antagonized by the rest, feel unwelcome.

Workers of Different Religion are liable to be antagonized, although the profession may be merely nominal on one or both sides, and perhaps those flocking under either religious banner can not tell for what it stands. The Irishman who spoke of men "cutting each others' throats for the love of God," unwittingly spoke a bitter truth.

Workers Strange to the Locality. My remarks concerning too many races of workers apply to some extent to those strange to the locality. They do not know where to go or what to do; are seized with homesickness, even when they come from much less desirable localities. (I have known Labradorians, of all men, to die of homesickness.) In consequence, their work is done listlessly, and they leave the town, sometimes even the country, and must be replaced by others, to be broken in to the work at the employers' expense. Strangers feeling like fish out of water may "pull up stakes" (pardon the mixed simile!) from sheer loneliness or discontent. This is true of both married and unmarried workers. The unmarried ones have

no place to go, the married ones' families have no friends.

Inclement Seasons will thin out the working force, particularly in lines, like ship building, mason work, etc., which expose the workers to physical discomfort in very hot or extremely cold or rainy weather. No one can blame a worker for objecting to remain in an inclement climate, especially where not merely his enjoyment of life is lessened, but that life itself is menaced. Inclemency of climate results in diminishing working will and capacity, and increased labor turnover.

Strongly Unionized Localities are noted for heavy labor turnover; quitting taking place *en masse,* and deranging the entire business. The General Electric Company moved from New York City to Schenectady largely on this account.

Lax Liquor Laws [1] breed defiance and discontent. Workers quit either voluntarily because they become shiftless, or are discharged of necessity. Drunken men strike more readily than sober ones.

Stringent Liquor Laws. On the other hand, very strict liquor laws and fanatical enforcement of those already existing, are apt to increase the turnover by compelling men who can not resist the craving for liquor, who " must have their drop of beer," and weak men who are easily led off by the vaporings of the professional agitator, to pull out for towns where liquor is easily had. Often it is " good riddance of bad rubbish " ; but for all that, such laws are a factor in in-

[1] See also elsewhere.

fluencing the labor turnover. "Of two evils, choose the lesser." The trouble is, that the manufacturer usually has no choice.

"Wet or Dry." This liquor question is a very ticklish one to handle; and much as I am in favor of freedom of action as well as of speech, what I have to say here is based on facts, not on idealism. Intoxicating drinks have been shown over and over again by competent, unprejudiced authorities to be depressants, not stimulants, as is generally supposed. Hospital records reveal that the proportion of deaths from a given disease is greater among drinkers than among non-drinkers; also that recovery from illness and wounds is slower. Prison records show that the proportion of criminals is greater among drinkers. Police-court records point to the same thing with those arrested for breaches of the peace and the like. Accident statistics in factories, and those compiled in connection with traffic accidents to and caused by drinkers lead to the same conclusion. No champion tennis player touches liquor; it affects the sight instantly.

If after looking up and testing the truth of these statistics, manufacturers still continue employing drinkers, let them stand the loss, or at least part thereof. All of it, they can not stand.

As regards compulsion: if it is permitted to "trample on inalienable rights" by forbidding the consumption of habit-forming drugs, and regulating prostitution, it should be lawful and expedient to prevent men from injuring themselves and others by the use of liquor.

Ill Health and Sickness as factors in the labor turnover may be larger than necessary by lack of provision for ordinary sanitation, and by neglect of the laws or usages in the matter of safeguards against the dangers inseparable from certain operations. They might be kept down by instruction in the ordinary rules of hygiene, and by frequent mental and dental examination and services. While such assistance may not be demanded by either legislation or the usages of the trade, it pays both directly by reducing the amount of sickness, and indirectly by giving the workers the impression that the employer considers labor as something more than a mere commodity.

(This is entirely independent of the question as to whether labor is or is not a commodity!)

Agitators. Few employees become unruly or unreasonable unless stirred up by agitators; usually professional "jaw carpenters." They are generally among the least competent and deserving among the group to which they belong, and very often agitate in an entirely different line to that in which they really can do any work at all. Thus we find paper-hangers agitating among ladies' waist-makers, and car-washers pretending to stand up for the rights of skilled mechanics. Their activities may be based on jealousy of the greater earnings of their fellows; or they may be merely fanatics on general principles; or possibly they are shrewd enough to see that besides gratifying their personal vanity they can make more money by

neither toiling nor spinning, than by copious secretion of the sweat of their brows.

As I write, the daily papers record the death of John Mitchell, long time head of the United Mine Workers, who left a fortune of $325,000, about which his heirs have started a squabble. Mine workers are among the best paid of American manual laborers, yet I would hardly wager that any one of them — or Mitchell himself — would be capable of leaving $325,000, earned by labor in any mine in the country. We all have heard of Denis Kearney, the Sand Lot orator of San Francisco. Denis stopped agitating against the tyranny of Capital when he became a property holder.

Unsatisfactory Relations between Employer and Employees will keep down the profits of any establishment. Of course I do not mean to say that workers should be coddled; in fact where they are ignorant aliens they have proved themselves apt to consider over-decent treatment as a sign of weakness on the employer's part, and take advantage thereof to make absolutely unwarranted demands. ("Put a beggar on horseback," and the rest of it.) Workers who have been compelled to take the middle of the street in Europe often want both sidewalks on this side of the Atlantic. The columns of every day's newspapers prove this. The Bolsheviki are only an extreme illustration of this principle. But where each employee understands that he will get a square deal, and has it borne in mind upon him that he is more likely to be

" worked " by the professional " jaw carpenter " than by the employer who has his money and reputation locked up in his manufactory, he is more likely to put forth efforts to please than where this is not impressed upon him kindly though firmly.

Just as in the Navy there are so-called " happy ships," where there are never any mutinies or unpleasantnesses, and no officers are " sent to Coventry," so there are " happy shops " where workers are as sure to take up the cudgels in defense of their employers as of their own families. I name the Endicott-Jones shoe factories as an example worthy of imitation. As a rule it is up to the employer to make his shop a " happy " one.

Discharges, which form so large a factor in the labor turnover, are often unnecessary in that they might have been prevented by proper selection and training of the workers. The discharge of many a good man is due to an incompetent, prejudiced or bad-tempered foreman. Some foremen do not know good work when they see it; or assign men to jobs for which they are not physically suited, or not trained; and as regards temper, re-hiring a worker with admission that the discharge was due to haste, is not uncommon.

This matter of unwarranted or untactful discharge has an important bearing on the strike question.

Human Nature plays a part in influencing the size of the turnover in that whenever work is slack those employed are apt to get, if not exactly " cocky," at least careful to avoid anything that might lead to even

just discharge. In dull times, when lay-offs increase, the turnover is low compared with that in busy periods.

Opposition of the Unions. One decided cause of loss to manufacturers is the active and passive opposition of the labor unions, which in most cases, while in their own minds only securing benefits to their members, are really standing in their own light as well as injuring their employers; not merely by "soldiering," but by failing to see beyond their own noses and to look about for methods and markets that would increase the demand for their product.

We hear a good deal from Bolshevistic, anarchistic, socialistic and Unionized labor sources about the tyranny of Capital (with a big, big "C"); yet Labor (with a big "L" and a big club) is much more tyrannical. Instance the heads of the four best paid classes in the world first enforcing the double-crew rule on railways, then going to Washington and holding up our President for greatly increased wages!

Instance the compositors, when a matrix for Wanamaker's or Hearn's advertisement is sent to one daily paper to be stereotyped there and issued to all the other dailies, using the stereotyped plates, and then after the editions have been run off, solemnly setting the page in each composing room, reading each proof, charging for the work, and finally melting the various unused forms.

Need I add that this sort of hold-up penetrates our entire industrial life? Need I remind you that it prevents manufacturers from making tenders or trying to make sales abroad?

Need I call the attention of workmen in other branches to the fact that this "hold up" on the part of the compositors is one of many similar ones which prevent employers from making concessions, even when they would be just — perhaps even from listening to grievances?

Labor costs such as this must be eliminated by popular action on the part of the consuming public.

In some few instances the Unions, as such, have been shown how blind they had been all along, and actually brought to take, in the interest of the craft, active measures for widening their sphere of action.

The granite block cutters were shown that only by accurate cutting to size could a smooth pavement be made; then the pavers' Union, that close and accurate laying was necessary to attain the same desirable result. The bread and butter interest of both Unions was awakened — but from without.

The journeymen lathers' Union brought about an increase in the weight of metal laths, which improved their work; also saw to it that (especially in view of the scarcity of carpenters) metal laths were tried out in competition with wood. Result: a great impetus to their line of activity.

Losses Due to Operatives' Qualities are many and widely differing; suggesting Mr. Venus'[1] "human warious." Those arising from their individual personality may be due to either

(1) Inherent qualities, or

[1] See "Our Mutual Friend."

(2) Acquired qualities.

Inherent Qualities are such as

(1) Physical weakness

(2) Physical inadaptability

(3) Mental deficiency, or

(4) Moral obliquity,

on the part of the operatives.

(The same causes may be inherent with the members of the directive force; yet I shall not discuss them separately.)

Physical Weakness is usually a handicap; and loss will result if a weak man is put at work demanding either muscular strength or endurance, no matter whether he be on piece work or not. Incidentally, the robust worker can often help in a pinch, at other work than his own; and if exceptionally strong may be glad of an opportunity to exhibit his strength.

Physical Inadaptability is entirely different from physical weakness; in fact, may be due to over-robustness. The long back and short legs adapt themselves well to tunnel and sewer work, but not to loom tending. The short chunky fingers that can tend a lathe may be utterly unfit for assembling typewriter parts. Of course, appearances are often deceitful. The most expert diamond setter I ever knew had a hand like a ham; in fact, one might say that he had no hand, only a fist.

Under "physical" inadaptability I will class slowness of movement; this being more a matter of nerves than of mental makeup.

Naturally, a one-eyed person would be useless for such work as calls for accurate judging of distances; and the loss of a thumb would cut him off from more kinds of work than the lack of two (some say three) fingers on the same hand. An epileptic might cause great damage by "throwing a fit" at a critical moment. In fact, among a lot of girls he might cause a panic.

Mental Deficiency on the part of an operative calls for more detailed and more frequent instruction and caution than the average; and mental defectives are more liable than normal persons to be injured. In addition, they are often affected with a certain low cunning that makes them suspicious; and they may injure their co-workers.

Moral Obliquity may be either

(1) Congenital, or

(2) The result of environment.

The "morally cross-eyed" operative has no hesitation in "soldiering," in "swiping," and in various other ways getting the better of either his employer or his fellows. Hence he causes loss, nine times out of ten, both directly and indirectly. He may also corrupt his fellows. It is all well enough to give the discharged convict a chance; he should have one; but while he should not feel watched or controlled more than the rest, temptation should not be put in his way. We who pray, "Lead us not into temptation," should not tempt honest men, much less those who have shown themselves dishonest.

Nine times out of ten the professional agitator is morally oblique. As good examples, Trotzky, *né* Braunstein, and Bela Kun, who started life as Adalbert Cohen. Or I might mention W. Z. Foster, I. W. W. agitator.

MISCELLANEOUS

Acquired Loss Causing Qualities may come either

(1) From within, or

(2) From without.

In other words, some of the unfavorably working characteristics may gradually form in the minds and consciences of human beings, as the result of their own observations and deductions; while others may be implanted either unconsciously through association with their fellows, or be the result of purposeful propaganda on the part of agitators and other mischief makers.

Acquired qualities may result from

(1) Lack of education

(2) Wrong education, or

(3) Misleading education.

Among these causes of loss may be noted

(1) Soldiering

(2) The drink habit

(3) The drug habit

(4) Discontent, or lack of interest.

Soldiering may really be a congenital vice; but as a rule no one is a born adept therein. It is learned almost unconsciously, or is compulsory where the Union is unscrupulous, as is often unfortunately the case.

The Drink Habit makes men incompetent and unsafe, and has always been one of the greatest sources of loss to the manufacturer. It remains to be seen if enactments will eliminate it.

Curiously enough, it may cause loss to manufacturers through two absolutely contradictory kinds of general legislation or local ordinances; namely,

(1) Too lax liquor laws

(2) Too strict liquor laws.

Lax Liquor Laws[1] and concomitant lax enforcement of such enactments as already exist, result in demoralization of the working force, readiness to listen to demagogues, decreased physical strength, increased absences and accidents on Monday, and a host of minor evils. Alcohol has been proved in these days to be, in the long run, a depressant; and any one who has traveled, who has either worked in or managed plants where the liquor laws are either lax or unenforced, must admit that the effect both on workers and on work is damaging.

Ask the workmen's wives!

The Drug Habit goes further than alcoholism in that it makes the addict an habitual and inexcusable liar.

Lack of Interest in the work, for other reasons than absence of incentive, tends to reduce quantity, or deteriorate quality, of output. It may be due to any one of four causes:

(1) Lack of variety (which may be compared to an unchanging diet)

[1] See also elsewhere.

(2) Much akin to the latter, certainty as to what will be the next change; comparable to a diet with daily changes repeated weekly.

(3) Absence of necessity for initiative or invention.

(4) Lack of due credit for work done, or for methods invented.

Levinstein found that of 2084 German miners, only 15.2 percent were interested in their work; of 1153 textile workers, but 7.1 percent; of 1803 metal workers, only 17 percent. While in all three classes the percentage is low, the metal workers seem to have had much more interesting work than those in textile branches.

Discontent and lack of interest lead to soldiering and drinking; and naturally, independent of the losses that they cause through these last, increase the labor turnover. They may be classed as curable evils.

Losses Due to Methods are either

(1) Technical
(2) Organizational
(3) Personal
(4) Accounting
(5) Purely commercial, or
(6) Miscellaneous.

Those in the fourth class are treated under "Commercial Losses"; the rest, under the respective headings and sub-headings.

I may say in general that methods cause more losses and more kinds thereof than any other set of factors.

Salesmen's Inefficiency. If salesmen do not know

the product "from the ground up," including the various stages of manufacture and the substitutes therefor, they can not present its claims properly. In addition, if they do not know salesmanship as both a science and an art, they can not present the claims of the product in such manner as to produce first attention, then interest, then desire to buy.

Too Expensive Managers. This condition is very frequently found. The remedy should be simple; but the question is: "What is a manager worth? Is any man, for instance, worth $100,000 a year?" My answer is: Certainly. There are dozens of such. A man is worth any salary whatever, when it is proved that his efforts alone bring in double that amount immediate net profit, over and above the normal earnings produced by the other factors. When the editor-in-chief of a certain New York daily complained to the proprietor that the business manager was getting twenty-five percent more salary than he was, the reply was: "By one improvement in folding alone, which he introduced on the presses, he enables us to use cheaper paper and thereby saves each year more than the amount of his salary." (Report is, that the editor cost the paper about the amount of his salary in libel suits.)

Men like Frank Hedley, Charles M. Schwab, John Hays Hammond, Sr., are worth what they have showed themselves to be worth. Why should one grudge a business manager a smaller salary than a custard-pie movie actor? Why fix the salaries of the manager and the buffoon on different bases?

There is, of course, the son-in-law evil. The above mentioned newspaper proprietor, when asked why he did not put his son in the office, instead of letting him cavort about Europe, replied: "It would cost too much. I give him $10,000 a year to spend on the other side of the Atlantic. To put him in the business would cost me $100,000."

False Economy. "Saving at the spigot and wasting at the bung-hole" is not a very common American fault, but we find it once in a while; more particularly when it is a matter of calling in outside help than when it concerns buying new equipment. Cheap employees are apt to be expensive, also. A stenographer who can "take" only 50 words a minute and write out 30, consumes more of her own time (and what is of more importance, of her employer's) than the slight saving in salary would pay for.

Profuse Correspondence. Both accounting and correspondence are rendered more expensive by taking time to write out frequently recurring terms in full. The work will be greatly facilitated, and to some extent money can be saved, by using symbols instead of names or phrases, to indicate departments, operations, accounts, etc. Up to date no attempt has been made among manufacturers to adopt standard symbolization, at least for each branch. This would save much time both in recording and in reading what has been recorded.

I would suggest that in preparing a symbol code either one of two principles be followed: alphabetical

arrangement in the order of sequence of operations, etc., or (as far as possible) the use of initials of the objects or operations symbolized.

Accidents are a cause of increased turnover. They are often due to the employers' neglect to supply safety appliances, cautionary signs, and proper instructions as to the use or non-use of certain equipment and materials.

Accidents to the Equipment cause a treble loss —

(1) That incurred in replacing or repairing the equipment itself

(2) That due to reduction of the output

(3) That due to idle time of machines and men.

Cutting Piece-Work Rates. This is one of the least economical practises in a factory or shop. Of course, from time to time the earnings of piece workers seem absolutely impossible to allow to continue; but as a rule, the instant an employer commences to cut a rate, that moment the workers begin to suspect him, and to soldier on day work in order to establish a maximum output for the job in question. As a rule, the worker eventually has the whip hand. He can defraud the dishonest or the grasping employer by ways and means some of which can not be detected, and others which can hardly be deemed inexcusable. He always has the last word. Often it is "strike."

Paying-off by Check. This has the advantage of doing away with the risk of the cashier being sandbagged on the way from the bank; but entails the evil that the workers are apt to get their checks cashed in

barrooms or the like (where these still exist) to their own detriment and the lowering of the morale and efficiency of the working force as a whole.

Paying-off on Saturday. This almost invariably brings with it, where liquor is to be had, decreased attendance on Monday and increase of spoilage and accidents on that day. Any manufacturer who has taken the trouble to accumulate statistics concerning attendance and accidents on that day can certify to the correctness of this statement. Even rabid anti-prohibitionists have been compelled to admit it.

Undesignated Bins and Shelves. Where all the stock is not properly arranged and the containers plainly and systematically marked with the name of the contents, delays occur; indeed, sometimes the stock-keeper may report none of the material on hand when there is plenty if he only knew it. Losses here, however, are principally due to the operatives' idle time caused by waiting for stock — especially where the planning is not such that all material and tools, etc., for any given job are ready to be taken up as soon as the preceding one is ended.

Excessive Insurance Rates eat up profits. Of course, there are some lines in which the rates will be high from the very nature of things; but often the provision for pumps, sprinklers, etc., will cut premiums to a point which will make the saving effected equal to a slight dividend. Rates are increased very often by having dangerous elements of small value near low-rate materials and buildings of great value.

Legislative Handicaps are of three kinds:

(1) Those tending to hamper all industries alike

(2) Those aimed at special branches, and

(3) Those aimed at special classes or organizations.

Very often they are the result of attempted blackmail on the part of politicians hoping to frighten the manufacturers into paying them to cease their attacks. A case in point was the attack on the oleomargarine industry, some years ago, in the New York Legislature. It was nominally in the interest of the "honest dairy farmer." I was retained by the principal manufacturers of "oleo" to fight the blackmailers; but my work was rendered much less necessary by the fact that the alarmed "honest farmers" (themselves among the heaviest purchasers of the product in question) came down to Albany in swarms to defend their "legitimate" interests.

Incidentally, the late Mr. Lammotte du Pont told me one day in the old Astor House that that hotel never had had decent butter until it commenced to use "oleo."

Overhead Too High. This is usually the result of bad organization, or else is due to financial factors.

Overhead may be too high either

(1) Actually

(2) Only proportionately, or

(3) Both actually and proportionately.

Few stop to consider this. We may cut down both overhead and either labor cost or material cost, with the result of increasing the proportion of overhead to both flat cost and total manufacturing cost.

To put this concretely we will take two hypothetical cases; one in which the labor is the main factor, the other in which material is the principal one, in flat cost.

	Factory A	*Factory B*
Labor	$25,000	$50,000
Material	50,000	25,000
Flat Cost	75,000	75,000
Overhead 33⅓% of flat cost	25,000	25,000
Total cost	$100,000	$100,000
Overhead to total cost	25%	25%

Then reducing labor cost by increasing overhead (through employment of an efficiency expert) we may have

Labor	$15,000		$30,000
Material	50,000		25,000
Flat cost	65,000		55,000
Overhead 46.15%	30,000	55.55%	30,000
Total cost	$95,000		$85,000
Overhead to total cost	31.38%		35.3%

In each of the above cases we have an increase in actual overhead and a decrease in overhead percentage.

Overhead Percentage Too Low. Those interested too often do not recognize the fact that a low overhead or a low percentage thereof may be a sign of, or the cause of, low efficiency. As an illustration of the value of overhead I may instance the cost of inspection. It is, no doubt, a burden; yet results in decreased spoilage and wastage, and general improved quality of product; and unless carried to an extreme (seldom the case), pays for itself over and over.

A second example is the cost clerk, who, if capable and backed up by good records, prevents the manufacturer from bidding so high as not to get contracts, or what is worse, bidding so low that having got them, he loses. The cost clerk's salary and the accompanying expenses are overhead items.

Again: the purchasing agent's salary and the cost of maintaining his department are chargeable to overhead; yet the economies produced by shrewd buying are often sufficient to permit declaring a dividend, which high manufacturing or selling expense would otherwise preclude.

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